

**Driver Certification Program**

**Class B Apparatus Driver Course**

**Student Reference Manual**







# What's the Big Deal?

**Poor driving habits, lack of skill, improper attitude, and lack of accountability for one member driving an emergency vehicle can alter many lives—uniformed and civilian.**

What other piece of equipment or tool carries nearly unlimited liability and may even subject an employee to criminal prosecution if they behave negligently?

## CODE OF MARYLAND STATES:

**THIS SECTION DOES NOT RELIEVE THE DRIVER OF AN EMERGENCY VEHICLE FROM THE DUTY TO DRIVE WITH *DUE REGARD FOR THE SAFETY OF ALL PERSONS*.**

What emergency operation occurs more often than driving? If you have no emergency responses during a shift, chances are good that your apparatus still leaves the station for an errand.

What piece of equipment costs more to replace or repair than a vehicle? A vehicle is often the most valuable tool placed under the care and control of an employee. Beyond the money, there is a domino effect that extends far past your station when apparatus goes out of service or a driver is NATD.

How often is emergency vehicle operation a topic of discussion around your kitchen table, at the white board, or during a company drill? Does the discussion involve problematic intersections, narrow streets, and in-cab tasks, or just tactical assignments based upon arrival order? Some may believe apparatus operations are solely the driver's responsibility, but in reality they require a *team effort* to be most effective.





# **Emergency Vehicle Operator Class B**

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What's the Big Deal?

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# MCFRS EVO Class B Course

## Module 1

### EMERGENCY VEHICLE OPERATOR CLASS "B"

Module 1  
Introduction  
Policies, Procedures, and Laws  
Practical Requirements



### COURSE ADMINISTRATION ENROLLMENT AND DOCUMENTS



- Finalize registration
    - Enrolled – everyone present?
    - Waitlist
  - Driver's License & History
    - Need a photocopy of current driver's license
    - Need a non-certified copy of motor vehicle record
  - Class Roster
    - Verify the pre-printed information and fill in the blanks
- For next class – you must bring a non-certified copy of your driving record.**

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### COURSE ADMINISTRATION ATTENDANCE



- Sign-in – EVERY class
- Every session is mandatory
  - If you must miss, discuss with the lead instructor as soon as possible
  - Accommodations for absences – sole discretion of the lead instructor
  - Make-ups must be documented
- Refer to the syllabus
  - For session dates
  - For session times – beware of night driving sessions
  - For session topics

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### COURSE ADMINISTRATION SUCCESSFUL COMPLETION



- Written Exam
  - 70% is passing
  - Pre-Trip
  - Vehicle Systems
  - Safe Driving Principles & Laws
- Practical Exercises
  - Pre-trip inspection
  - Air brake test
  - Road behavior evaluation
  - Cone course – zero cones; <10 minutes



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### PROGRAM GOAL



To provide each driver/operator with the basic skills and knowledge required to safely, efficiently, and effectively operate heavy fire apparatus

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### LESSON OVERVIEW



- Why Class "B" Driver Course
  - Motivation
- Regulatory & Policy Considerations
  - COMAR, 808, 04-21
- Case Study – W717
- Safe Driving Practices
  - Smith System, SIPDE, Collision Reduction
- Practical Skills

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### WHY CLASS B CLASS?



### WHY CLASS B DRIVER COURSE? § 11-118 EMERGENCY VEHICLE – DEFINED



"Emergency vehicle" means any of the following vehicles that are designated by the Administration as entitled to the exemptions and privileges set forth in the Maryland Vehicle Law for emergency vehicles:

- (2) Vehicles of volunteer fire companies, rescue squads, fire departments, the Maryland Institute for Emergency Medical Services Systems, and the Maryland Fire and Rescue Institute;
- (3) State vehicles used in response to oil or hazardous materials spills;
- (5) Ambulances; and
- (6) Special vehicles funded or provided by federal, State, or local government and used for emergency or rescue purposes in this State.

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### WHY CLASS B DRIVER COURSE? COMMERCIAL DRIVERS' LICENSE EXEMPTION



#### § 16-102. Persons exempt from licensing requirements

- (a) In general. – The licensing requirements of this title do not apply to:
- (12) A member or employee of a fire department, rescue squad, emergency medical service unit, or volunteer fire company while driving an emergency vehicle if the driver:
- (i) Holds a valid Class C license issued to the driver under section 16-104.1 of this subtitle;
  - (ii) Has been authorized by the political subdivision that operates a fire department rescue squad, emergency medical services unit, or volunteer fire department to operate the type of emergency vehicle being driven; and
  - (iii) Is driving the emergency vehicle in the performance of the official duties of the driver in or out of state.

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### WHY CLASS B DRIVER COURSE? TRAINING REQUIREMENTS



#### § 16-102. Persons exempt from licensing requirements

- (b) Regulations.
- (1) The Administration shall adopt regulations that establish *mandatory training and testing requirements* that a political subdivision that operates a fire department, rescue squad, emergency medical services unit, or volunteer fire department must implement before the political subdivision may authorize an individual to operate an emergency vehicle in accordance with subsection (a)(12) of this section.

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### MOTIVATION



Medic 730  
Roll-over crash

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### MOTIVATION



October 16, 2014  
Engine 723 collides with A721




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### MOTIVATION



Engine 733 loses control  
May 23, 2016

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### MOTIVATION



March 29, 2005  
Fort Detrick engine company  
collides with civilian car in  
Frederick

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### STATISTICS

In 2010.....  
32,885 people were killed in crashes  
2,239,000 people were injured

55% of passengers killed were unrestrained

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### MOTIVATION

#### NFPA STATISTICS 1998-2007

- Consistently the 2<sup>nd</sup> leading cause of FF fatalities
- 148 deaths in 133 crashes in 10 years
  - 110 of the fatalities were drivers
- 80% of the crashes were during a response

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### MOTIVATION

- Heavy apparatus operators make more independent decisions than any other member of the crew
  - Pre-response
  - In transit
  - Arrival
  - Operating
- Apparatus is the most valuable asset placed under your control
- Apparatus has the potential to cause unlimited liability personally and professionally

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### PUBLIC IMAGE

#### THE WASHINGTON POST

August 2004



November 2015

**A leading killer of firefighters: crashing the truck on the way to a call**



Accidents involving ambulances and fire trucks per 10,000 calls

Montgomery County  
Prince Georges County

2000 2014

Source: Montgomery County Fire and Rescue, Prince Georges County Fire and Emergency Medical Services, Department of Transportation

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# MCFRS EVO Class B Course

## Module 1

### PUBLIC IMAGE FIREHOUSE MAGAZINE

This article was written by Matthew Mosk of the Washington Post, titled "Montgomery Fire, Rescue Crashes Rise." Drivers of Montgomery County fire trucks and ambulances have had more than 1,100 accidents in the last five years.....Service is at risk of losing its insurance coverage. Montgomery has received warnings from its insurance underwriter. Departmental reviews of the most serious accidents, including crashes that left one motorist dead and more than a dozen injured, have found that many could have been avoided had drivers slowed before entering intersections or followed proper procedures as they responded to emergency calls. Montgomery Officials have known for at least three years that their department's driving record was deficient and that the numbers have been getting worse-up from 154 crashes in 1997-98 to 217 in 2001-02. The county's underwriter, Volunteer Firemen's Insurance Services Inc., has charged progressively higher premiums each year since 2000. In 2002, premiums rose 18 percent to \$1.2 million. With accident costs still rising in December, the fire chief sent a bulletin....."due to the high number of claims." "A major component of this problem is the number of preventable collisions we are currently experiencing," the chief wrote.

November 2003  
Excerpts from  
Michael Wilbur's  
Emergency Vehicle  
Operations column

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### HISTORY MONTGOMERY COUNTY



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### LOGIC

**"YOU HAVE NO RIGHT  
TO RISK PEOPLE'S  
LIVES ON THE HIGHWAY  
TO SAVE  
PEOPLE WHO MAY BE  
TRAPPED IN A FIRE"**



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### CONTROLLING THE BEAST

- Since recruit school the emphasis has been SPEED
- When the tones drop the emphasis is SPEED
- Going down the road the emphasis is.....

*Being the driver you have to learn to control the aggression and focus it in order to deliver the apparatus safely.*

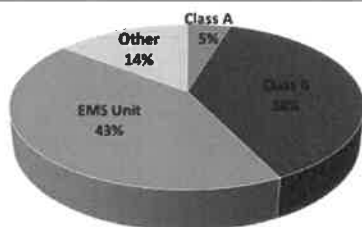


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### STATISTICS COLLISIONS BY VEHICLE TYPE - 2013-2015



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### SAFE DRIVING PRINCIPLES PHILOSOPHY

We will drive safely despite the incorrect or reckless actions of other roadway users.

Assume the other driver....

....does not see you

....does not hear you

....will not yield to you

....will put their vehicle in your path

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### SAFE DRIVING PRINCIPLES RESPONSIBILITY



Drivers are responsible for:

- Ensuring the apparatus is ready for service
- Ensuring the apparatus is maintained and mechanically sound
- Developing and maintaining their own skills and knowledge
- Anticipating lack of skill and knowledge of pedestrians and other drivers
- Maintaining situational awareness to predict hazards and take action to mitigate them
- Knowing and complying with applicable laws and policies

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### REGULATORY & POLICY CONSIDERATIONS

Maryland Code – Transportation  
MCFRS Policy 808  
MCFRS Directive 04-21



### MARYLAND CODE – TRANSPORTATION § 21-106 - EMERGENCY RESPONSE



- Privileges are granted when:
  - Responding to an emergency call;
  - Responding to, but not while returning from, a fire alarm
- Privileges granted to fire department drivers are:
  - (1) Park or stand without regard to the other provisions of this title;
  - (2) Pass a red or stop signal, a stop sign, or a yield sign, **but only after slowing down as necessary for safety**;
  - (3) Exceed any maximum speed limit, but only so long as the driver does not endanger life or property;
  - (4) Disregard any traffic control device or regulation governing direction of movement or turning in a specified direction (no left turn, no u-turn, etc.)

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### LEGAL TERMS



**A TRUE EMERGENCY** is a situation in which there is a high probability of death or serious injury to an individual or significant property loss, and action by (you) an emergency vehicle operator may reduce the seriousness of the situation.

-United States Department of Transportation

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### MARYLAND CODE – TRANSPORTATION § 21-106 - EMERGENCY RESPONSE



- Privileges apply only while the emergency vehicle is using audible and visual signals
- Driver not relieved from duty of care. -- **This section does not relieve the driver of an emergency vehicle from the duty to drive with due regard for the safety of all persons.**

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### MARYLAND CODE – TRANSPORTATION § 21-405 & § 21-510 – YIELD TO EMERGENCY VEHICLES



On the immediate approach of an emergency vehicle using **audible and visual signals**:

- Drivers and pedestrians shall *yield the right-of-way*.
- Drivers shall drive immediately to a *position parallel to and as close as possible to the edge or curb of the roadway*, clear of any intersection.
- Drivers shall stop and stay in this position until the emergency vehicle has passed.

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### MARYLAND CODE – TRANSPORTATION

#### § 21-706 - PASSING SCHOOL VEHICLE



- (a) If a school vehicle has stopped on a roadway and is operating the alternately flashing red lights, the driver of *any other vehicle* meeting or overtaking the school vehicle shall stop at least 20 feet from the front or rear of the school vehicle.
- (b) If a school vehicle has stopped on a roadway and is operating the alternately flashing red lights, the driver of any other vehicle meeting or overtaking the school vehicle may not proceed until the school vehicle resumes motion or the alternately flashing red lights are deactivated.
- (c) Exceptions. -- This section does not apply to the driver of a vehicle on a divided highway, if the school vehicle is on a different roadway.

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### MARYLAND CODE – TRANSPORTATION

#### § 22-218 - AUDIBLE AND VISUAL SIGNALS



- Every emergency vehicle, in addition to any other equipment and distinctive markings required, shall be equipped with a siren, exhaust whistle, or bell capable of giving an audible signal.
- Every emergency vehicle, in addition to any other equipment and distinctive markings required by the Maryland Vehicle Law, shall be equipped with signal lamps mounted as high as practicable, which shall be capable of displaying to the front and to the rear a flashing red light or lights. These lights shall have sufficient intensity to be visible at 500 feet in normal sunlight.
- Fire Apparatus and Ambulances may be equipped with or display red and/or white lights or signal devices.

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### MARYLAND CODE – TRANSPORTATION

#### § 21-1120 - WEARING HEADSETS



- The wearing of earplugs, headsets, or earphones while driving a motor vehicle is prohibited under normal circumstances.
- The prohibition of headsets does not apply to a person operating an authorized emergency vehicle:
  - Under emergency conditions; or
  - Who is wearing a headset for the purpose of communicating with other emergency personnel.

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### MARYLAND CODE – TRANSPORTATION

#### § 21-1110 - CROSSING FIRE HOSE



Unless he has the consent of the fire department official in command, the driver of a vehicle may not drive over any unprotected hose of a fire department that is laid down on any highway or private driveway.

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### LEGAL TERMS



- **Negligence**
  - a failure to exercise the care that a reasonably prudent person would exercise in like circumstances.
  - COMAR - Negligent driving.- A person is guilty of negligent driving if he drives a motor vehicle in a careless or imprudent manner that endangers any property or the life or person of any individual.
- **Gross Negligence**
  - a conscious, voluntary act or omission in reckless disregard of a legal duty and of the consequences to another party
- **Willful and Wanton**
  - denotes conduct that is extreme and outrageous, in reckless disregard for the rights of others

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### MARYLAND CODE – TRANSPORTATION

#### § 19-103 - LIABILITY FOR NEGLIGENT OPERATION



(b) Liability of operator. -- An operator of an emergency vehicle, who is authorized to operate the emergency vehicle by its owner while operating the emergency vehicle in the *performance of emergency service*.....shall have the immunity from liability described under § 5-639(b) of the Courts and Judicial Proceedings Article.

- **Emergency Service:** responding to an emergency call or fire alarm
- § 5-639 does not provide immunity from suit to an operator for a malicious act or omission or for gross negligence of the operator

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### MARYLAND CODE – TRANSPORTATION DUTY OF CARE



**None of the privileges or exceptions in the statutes relieve the driver of an emergency vehicle from the duty to drive with due regard for the safety of all persons.**

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### MCFRS REFERENCES



- **Policy 808** – Safe Emergency Vehicle Operation
  - Fitness for duty
  - Vehicle preparedness
  - Driving procedures
- **Directive 04-21** – MCFRS Safe Driving Action Plan
  - Reducing response mode
  - Maximum speeds
  - EMS transport priorities
  - Collision reporting
  - Cell phone use

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### MCFRS GUIDANCE POLICY 808



- During routine driving, fire apparatus has no exemptions from traffic laws
- Personnel not confident in operating a vehicle should request additional training or practice
- Drivers must not knowingly drive/operate vehicles with mechanical defects that could effect safety
  - Notify your officer
  - Consult with CMF
  - MCFRS OOS criteria

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### MCFRS GUIDANCE POLICY 808



- Driver's licensing**
  - Must possess a valid non-provisional motor vehicle operator's license
  - License status changes (revocation, suspension, disqualification, downgrades) must be reported to a supervisor and cease driving fire apparatus
  - Convictions for any moving violation must be reported to a supervisor
- Fitness for duty**
  - Physical conditions
  - Medications
  - Fatigue or psychological impairments

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### MCFRS GUIDANCE POLICY 808



Apparatus drivers must:

- Strive to eliminate their own errors and allow for lack of skill or improper actions of other drivers
- Adjust to unusual weather, road and traffic conditions, and avoid being led into collisions by unsafe acts by others
- Recognize situations that lead to collisions, identify prevention options, and execute options to avoid collisions
- Remain accountable for their actions and operate within acceptable policies, procedures, and laws

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### MCFRS GUIDANCE POLICY 808



**Intersections**

- Must reduce speed at all intersections to negotiate a full stop when the intersection cannot be safely entered
- Speed must allow the vehicle to remain fully controlled and safely stopped to avoid a collision
- Drivers must anticipate the need to yield to any vehicle already in any part of the intersection when responding against a red light
- Right-of-way may have to be yielded to avoid a collision



**Statute and policy do not require a full stop, however you must slow down to be able to stop.**

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### MCFRS GUIDANCE POLICY 808



#### Following other apparatus

- At least 3 seconds interval
  - ✦ Vary your siren pattern
  - ✦ Traffic assumes there is just one emergency vehicle

#### Night driving

- Stopping distance must be within the forward view of the vehicle headlights – do not outride the sight distance

#### Pedestrians

- Always have the right-of-way
  - ✦ Statute requires pedestrians to yield, however you are obligated to avoid a collision even if right-of-way has to be given away

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### MCFRS GUIDANCE POLICY 808



- Drive to accommodate the unpredictable behavior of other drivers
- Vehicle clearance and height
  - Know your vehicle
  - Avoid tight clearance situations when possible
  - Officer must dismount and guide the driver in tight clearances
- Drivers must be aware of vehicle height, weight, and ground clearance

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### MCFRS GUIDANCE POLICY 808



#### Overhead Doors

- Never enter an opening with a moving overhead door
- Never stop or park in an overhead door opening
- Never activate an overhead door with a vehicle in the opening
- Never activate an overhead door without a full view of the vehicle and door by either the door operator or a spotter
  - ✦ Do not rely upon automated sensors to stop overhead doors
  - ✦ Assume all overhead doors are on a timer
  - ✦ In an unfamiliar station, determine the operating characteristics of the overhead doors during shift change

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### MCFRS GUIDANCE POLICY 808



#### Parking

- During emergencies or fire prevention activities – use fire lanes or unconventional spaces when other spaces are not available
- All other times – use regular parking spaces
  - ✦ During non-emergent situations, park to avoid backing or becoming trapped by other vehicles
  - ✦ Use the less congested areas of parking lots or streets around businesses to minimize conflict with other vehicles

#### Alleys, Driveways, or Buildings

- Stop immediately prior to driving onto a sidewalk or roadway
- Yield to pedestrians and vehicles

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### MCFRS GUIDANCE POLICY 808



#### Backing

- Unit officer must dismount to the driver's side rear of the apparatus
- Unit officer will establish eye contact with the driver – if lost the vehicle must stop
- Additional personnel may be positioned to assist
- Use of spotters does not relieve the driver of responsibility for safe vehicle operation

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### MCFRS GUIDANCE POLICY 808



#### Backing

- If no spotter is available, the driver must conduct a circle check before backing
- EMS units must use spotters if possible, including at hospitals
  - If no spotter is available, driver must conduct a circle check
- All vehicles must use a spotter or the driver must conduct a circle check except for passenger size vehicles
  - Staff cars, command buggies, brush trucks
- Spotters must use standardized hand signals

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## Module 1

### MCFRS GUIDANCE POLICY 808



- Responding units must not pass each other unless advised to do so by the lead unit
- Responding units may not pass a school bus that is displaying flashing red lights – establish eye contact with the bus driver and proceed only at their direction
- During all travel, apparatus must stop at all unguarded railroad crossings
  - Guarded and unguarded crossings require looking and listening for train traffic before proceeding

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Module 1

### MCFRS GUIDANCE POLICY 808



- During emergency response, units must allow sufficient distance between responders based upon road conditions, traffic, etc.
  - Beware that motorists who yielded to another responder may not yield to you!
- During emergency response, drivers may exercise the privileges granted to them by statute when:
  - Ensuring the safety of persons and property, and
  - Weather conditions and visibility provide an adequate field of view

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### MCFRS GUIDANCE POLICY 808



- Drivers need to know their area
  - Be aware of the running routes of other responding units – anticipate intersecting paths
  - Know areas that require special consideration – dips, hills, intersections, gridlock areas, steep changes in grades, construction or detours, weight restrictions, height restrictions, school zones
- Slow down while approaching the scene!
  - Let the officer complete a size-up
  - Identify an advantageous position for the apparatus
  - Bystanders will be distracted by the incident

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### MCFRS GUIDANCE POLICY 808



- Personnel must not mount or dismount moving apparatus.
  - Officers and drivers are responsible for passengers being seated and/or restrained before moving
  - Riding the tailboard is forbidden
- Headlights are to be used during emergency responses and when windshield wipers are needed
- Driving with snow chains
  - Adhere to the speed guidelines provided by the chain manufacturer
  - Open the cab windows at least 3"
  - All crew members need to listen for broken chains
  - Broken chains require the unit to stop and repair or remove the broken chain

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### MCFRS GUIDANCE POLICY 808



- Wheel chocks must be used whenever parked anywhere outside of the station
  - Passenger size apparatus may use parking brakes in lieu of chocks
  - On grades, turn wheels toward the curb
- Daily apparatus checks should ensure compartment doors, cab doors, loose tools and equipment are secure to prevent loss or damage during travel
- Functional checks of visual and audible emergency equipment should be done in a manner that does not confuse passing motorists
  - Check warning lights indoors with the bay door down
  - Sound audible devices for a short duration with the warning lights off

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### MCFRS GUIDANCE DIRECTIVE 04-21



- Unit officers on the scene of "routine" incidents should consider reducing incoming units to non-emergency response
- Unit officers are responsible for the driver's actions
  - Direct the driver to slow down
  - Direct the driver to cease unsafe operations
  - Authority to discontinue a response if necessary
- MCFRS drivers may not exceed the posted speed by more than 15mph at any time during emergency responses

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# MCFRS EVO Class B Course

## Module 1

### MCFRS GUIDANCE DIRECTIVE 04-21



- During emergency responses drivers must be able to come to a complete stop at all intersections to avoid a collision
- All personnel in MCFRS vehicles must wear seatbelts
  - Unit officers are responsible for authorizing movement of the vehicle
- All MCFRS vehicle collisions must be reported immediately by the investigator to the Safety Office
  - Safety Officers
  - Battalion Chiefs
- Cell phone use while operating medium or heavy duty apparatus is forbidden

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Module 1

### MCFRS CASE STUDY

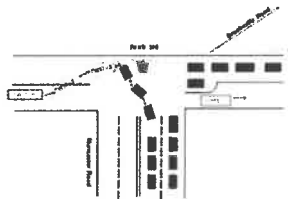
Tanker 717 Collision



### TANKER 17 – FATAL COLLISION JUNE 22, 2000



- Multiple responding units
- Zone of confusion
- Evasive maneuver



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## SAFE DRIVING PRACTICES

Driving safely despite the actions of others  
Smith System & SIPDE  
Safe Behaviors  
Collision Reduction




## WHAT MAKES A SAFE DRIVER?

A safe driver knows.....

**What to do**


**How to do it**

**When to do it**



## SITUATIONAL AWARENESS


- Accurate perception and understanding of all the factors and conditions within the four fundamental risk elements that affect safety before and during travel
- Fundamental Risk Elements:
  1. the driver
  2. the vehicle
  3. the environment
  4. the type of operation



## THE DRIVER

- Mental preparedness
  - Are you focused?
  - Are you stressed?
- Physical preparedness
  - Are you tired?
  - Are you handicapped?
  - Are you sober?

**YOU control this element!**



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## Module 1

### THE VEHICLE

- Mirrors intact and adjusted
- Seat intact and adjusted
- Pre-Trip Inspection done
- Interior housekeeping
  - Portable radios
  - Helmets
  - Map books
  - Drinks
- Cargo secure

**YOU control this element!**



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### THE ENVIRONMENT AND OPERATIONS

- Surroundings/Setting
- Weather
- Road configuration
- Road conditions
- Traffic conditions
- Vehicle interior and accessories
- Parking



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### SMITH SYSTEM

Aim High in Steering

Get the Big Picture

Allow an Out

Keep your eyes moving



Smith System  
"Street Smart" DVD

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### AIM HIGH SMITH SYSTEM

- Look at the area 8 to 12 seconds ahead of your vehicle
- Center your vehicle in the driving lane
- Find the path of least resistance
- Adjust your following distance
- Blend into the flow of traffic



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### GET THE BIG PICTURE SMITH SYSTEM

- Know what is ahead, beside, and behind you
- Predict other drivers' actions
- Hear the radio traffic
  - What other units are enroute?
  - Are there other calls in the same area?
  - Is there a true emergency?
- Listen for other sirens
- Find trouble before it finds you

**The "big picture" is vital to safe driving**

Rev. 6/9/18

EVOG - Class B

Module 1

### BESIDE AND BEHIND YOU THE BIG PICTURE

- Always know what's happening beside you
- Check mirrors before slowing down, stopping, decelerating
- Check mirrors on long or steep hills
- Convex mirrors tell a bigger story
- Depth perception can be altered by mirrors
  - Know landmarks on the apparatus to aid with depth perception



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EVOG - Class B

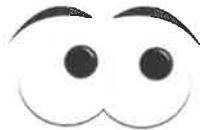
Module 1

# MCFRS EVO Class B Course

## Module 1

### KEEP YOUR EYES MOVING SMITH SYSTEM

- Do not fixate on one area or object
- Key to remaining alert and engaged
- Check the mirrors frequently
- Becomes difficult at night or when fatigued
- Random eye movement is bad
- Staring at an object also leads to drifting toward the object



Rev. 6/018

EVOB - Class B

Module 1

### ALLOW AN OUT SMITH SYSTEM

- Maintain adequate following distance
  - "Decision Space"
- Be prepared to yield
- Don't get boxed in
- Time your passing moves
- When stopped in traffic, keep a gap ahead of you to allow a lane change

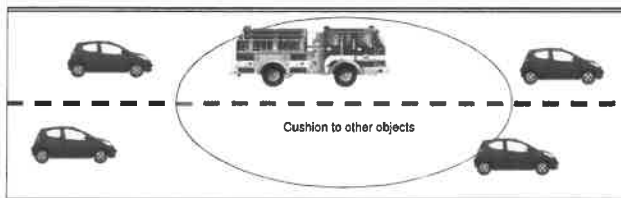


Rev. 6/018

EVOB - Class B

Module 1

### DECISION SPACE ALLOW AN OUT



Impossible in the DC Metro area?

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EVOB - Class B

Module 1

### DECISION SPACE ALLOW AN OUT

Perception Time +  
Reaction Time +  
Braking Time =



**Stopping Distance**

Perception	$\frac{3}{8}$ to $\frac{1}{4}$ second
Reaction	$\frac{1}{4}$ second
Add $\frac{1}{2}$ to 1 second for air brake lag time	
Braking	2 $\frac{1}{2}$ seconds
Stopping Time	5 seconds
Based upon 40 mph on wet roads.	

Rev. 6/018

EVOB - Class B

Module 1

### STOPPING DISTANCE ALLOW AN OUT

Dry road; 25mph = 38 ft/sec

Perception	Reaction	Braking	=	Stopping Distance
28 $\frac{1}{2}$ feet	66 $\frac{1}{2}$ feet	32 feet	=	127 feet

Wet road; 25mph = 38 ft/sec

Perception	Reaction	Braking	=	Stopping Distance
28 $\frac{1}{2}$ feet	66 $\frac{1}{2}$ feet	56 feet	=	151 feet

Dry road; 40mph = 59 ft/sec

Perception	Reaction	Braking	=	Stopping Distance
44 $\frac{1}{2}$ feet	103 $\frac{1}{2}$ feet	78 feet	=	225.5 feet

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EVOB - Class B

Module 1

### STOPPING TIME – AIR BRAKE UNIT ALLOW AN OUT

Vehicle Speed		Dry Pavement Coefficient of Friction = 0.7		Wet Pavement Coefficient of Friction = 0.4	
		Stopping Distance	Stopping Time	Stopping Distance	Stopping Time
60	90	407 ft	4.5 sec	542 ft	6 sec
45	66	262 ft	4 sec	336 ft	5 sec
35	51	185 ft	3.6 sec	229 ft	4.5 sec
25	38	127 ft	3.4 sec	149 ft	4 sec

How do you measure your decision space?

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EVOB - Class B

Module 1

# MCFRS EVO Class B Course Module 1

## DECISION SPACE – 4 SECOND RULE ALLOW AN OUT

Apparatus traveling on wet pavement at 60mph

<40mph: 4 seconds  
 Each additional 10mph: 1 second  
 Poor Road Conditions: 1 second

Time Interval = 7 seconds

Rev: 04/18 EVOB - Class B Module 1

## DECISION SPACE ALLOW AN OUT

Vehicle Speed MPH	Dry Pavement	4-Second Rule	Wet Pavement	4-Second Rule
	Stopping Time	Interval Time	Stopping Time	Interval Time
60	4.5 sec	4+1+1 = 6 sec	6 sec	4+1+1+1 = 7 sec
45	4 sec	4+1 = 5 sec	5 sec	4+1+1 = 6 sec
35	3.6 sec	4 sec	4.5 sec	4+1 = 5 sec
25	3.4 sec	4 sec	4 sec	4+1 = 5 sec

In each situation you have enough time to perceive the hazard, react, and stop.

Rev: 04/18 EVOB - Class B Module 1

## DECISION SPACE ALLOW AN OUT

Even when stopped, leave sufficient space between your vehicle and the vehicle ahead:


- Vehicle in front starts to roll back
- Car behind needs more space to stop
- Car ahead becomes disabled
- You get a call!

"safety wedge"

Rev: 04/18 EVOB - Class B Module 1

## KEEP YOUR VEHICLE VISIBLE SMITH SYSTEM

- Know where you are going
- Pick a lane early and stick with it
- Signal your intentions
- Make eye contact
- Pay attention
- Slow down ahead of gridlock



Rev: 04/18 EVOB - Class B Module 1

## SIPDE PROACTIVE DRIVING FORMULA

- Sense
  - You need to see/hear/smell/feel it
- Identify
  - Your brain needs to recognize it
- Predict
  - Your brain needs to figure out what is going to happen
- Decide
  - What are your options based upon your prediction?
- Execute
  - Make it happen

Rev: 04/18 EVOB - Class B Module 1

## DECISION MAKING

Seeing  
Hearing  
Feeling

Knowledge - Training  
Experience - Attitude

**DECISIONS**

Rev: 04/18 EVOB - Class B Module 1

# MCFRS EVO Class B Course

## Module 1

### SAFE BEHAVIORS BACKING

- Planning ahead to minimize backing
  - Eliminate the need to back – find another route
  - Position to back to open areas or away from obstacles
  - If you can avoid backing, don't do it!
- As you pull into an area, notice landmarks or obstacles that will be behind you when backing – leave yourself space!
- Avoid backing into open roadways or uncontrolled traffic
- Backing needs to be smooth and methodical
  - Steering and pivot points will be much more pronounced when in reverse

Rev. 6/013

EVOB - Class B

Module 1

### SAFE BEHAVIORS BACKING

- Spotter priorities – rear driver's side → front curb side → rear curbside
- If there is no spotter available:
  - Reconsider backing up. Is it really necessary right now?
  - Make a reasonable attempt to get someone to act as a spotter.
  - If a spotter cannot be obtained, get out the unit and walk around the unit completing a "circle of safety" and survey the backing area. Before proceeding to back unit, being sure to also check overhead clearance.
- Give a final warning of two horn blasts just prior to backing.
- If you lose sight of spotters – STOP
- The best spotter is another apparatus operator

Rev. 6/013

EVOB - Class B

Module 1

### SAFE BEHAVIORS BACKING

Before and during backing the driver should:

- Roll down their window
- Remove their headset
- Give clear directions to the backers
- Go only as fast as the backers can adjust
- Check both mirrors and the backup camera – do not fixate; keep your eyes moving
- Back only as far as necessary

**GET  
OUT  
AND  
LOOK**

Rev. 6/013

EVOB - Class B

Module 1

### SAFE BEHAVIORS BACKING

Effective spotters:

- Know the intended path of the vehicle
- Maintain eye contact with the driver and know the blind spots
- Remain focused on the task and take it seriously
- Look behind, around, below, and above the vehicle
- Wear traffic vests and carry handlights
- Recognize stopping distance requires reaction time and braking distance – signal before it is too late!
- Use visible, clear, and recognized hand signals
- Stop the driver if uncertainty develops

Rev. 6/013

EVOB - Class B

Module 1

### SAFE BEHAVIORS BACKING

Effective spotters:

- Conduct a circle check of the vehicle of their own
- Identify and communicate any potential obstacles or hazards to the driver
- Position themselves 8-10 feet away from the apparatus and in the line of sight of the driver
  - Avoid being in pinch points between the apparatus and fixed objects
- Use a talk-around channel when conditions make verbal communications between the driver and the ground personnel important, i.e. low-visibility, complex maneuvers, confined areas

Rev. 6/013

EVOB - Class B

Module 1

### BACKING STANDARD HAND SIGNALS



STOP



TURN




DIMINISHING CLEARANCE

Rev. 6/013

EVOB - Class B


Module 1



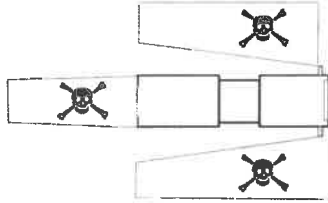
### When possible, avoid backing! If you must back...

- Key 1 AIM HIGH IN STEERING.**  
⇒ Choose the safest location possible
- Key 2 GET THE BIG PICTURE.**  
⇒ Search for all potential hazards
- Key 3 KEEP YOUR EYES MOVING.**  
⇒ Scan, don't fixate
- Key 4 LEAVE YOURSELF AN OUT.**  
⇒ Surround yourself with space
- Key 5 MAKE SURE THEY SEE YOU.**  
⇒ Use warning devices - Make eye contact

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EYOC - Class B
Session 1




### SAFE BEHAVIORS APPARATUS BLIND SPOTS



If you cannot see the driver, they cannot see you!

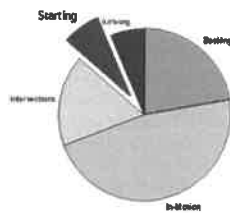
If you can see the driver, do not assume they see you!

Rev. 04/18
EYOC - Class B
Module 1




### COLLISION REDUCTION PRE-DEPARTURE & DEPARTURE

- Daily Apparatus Check
- Circle Check
- Adjustments
- Seat Belts
- Visual Scan




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EYOC - Class B
Module 1



### PRE-TRIP PRE-DEPARTURE


- Starts at shift change
  - What have other shifts already discovered?
  - Defect reports
- Identifies defects
  - Non-critical – operator adapts
  - Critical – unit OOS?
- Address minor deficiencies
- Mirror & seat adjustments
- Documentation

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EYOC - Class B
Module 1




### ADJUSTMENTS & DOT INSPECTION PRE-DEPARTURE

- Seat position
- Steering wheel position
- Mirrors
  - Flat
  - Spot
  - Clean?
- Windows
  - Clean inside
  - Clean outside
  - Free of obstructions or defects?
- Rear spot lights
- Functional and physical checkout of major components (Session 2)





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EYOC - Class B
Module 1



### CIRCLE CHECK - 360° PRE-DEPARTURE

- Sides
  - Compartment doors
  - Ladders
  - Running boards – loose items
  - Portable radio straps
- Front & Rear
  - Hose & Nozzles
  - Appliances/Humat Valves
  - Loose items and people
- Below
  - PPE
  - Obstructions or forgotten equipment
  - Wheel chock
- Takes seconds to save minutes

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EYOC - Class B
Module 1

### CREW SECURITY PRE-DEPARTURE

- Is the crew ready for the truck to move?
- All crew members seated and restrained
- Members having trouble
  - Practice getting dressed
  - Practice buttoning up while seated and belted
  - Practice donning SCBA from the seat
- 76% of firefighters killed in vehicle crashes were unrestrained

SANDY LEE'S  
STORY

Rev. 6/4/15

EVOG - Class B

Module 1

### COLLISION REDUCTION IN TRANSIT

- Departure visual scan
- Eye movement
- Cover the Brake
- Safe Speed
- Steering
- Signaling
- Traffic Signs & Signals

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EVOG - Class B

Module 1

### DEPARTURE - VISUAL SCAN IN TRANSIT

- Complete a visual scan of the field of vision before moving
  - Pedestrians
  - Other apparatus
  - Civilian vehicles
  - Station personnel
- Ensure the bay door is fully open
  - Collision sensors are no help when door is going up
- Proceed slowly through the door opening
  - Note blind spots outside the door
  - Door frame creates a pinch point

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Module 1

### EYE MOVEMENT IN TRANSIT

What do you see?

What are the hazards to your apparatus?



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Module 1

### EYE MOVEMENT IN TRANSIT



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Module 1

### EYE MOVEMENT IN TRANSIT

What do you see?

What are the hazards to your apparatus?



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Module 1

### EYE MOVEMENT IN TRANSIT



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Module 1

### COVER THE BRAKE IN TRANSIT

- Cover the brake when you identify a probable hazard
- Approaching, entering, or traversing intersections
- Remove foot from accelerator and prepare to brake
- Advantages
  - Immediately decreases speed – Telma engages
  - Stopping distance decreases
  - Reduces reaction time
  - Requires a pause to accelerate

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Module 1

### SAFE SPEED IN TRANSIT

- Posted speed limits are for good conditions
- Slow for less than ideal conditions
- Smooth acceleration and deceleration
- Maintain adequate space cushions
- Your best defense is to **SLOW DOWN**



*Posted speed limits are for ideal conditions*

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Module 1

### STEERING IN TRANSIT

- Hold steering wheel firmly
- Two hand skill – shuffle steer
- Hands positioned at 10 and 2
- At-Risk Behaviors to avoid
  - Hands in the spokes
  - One-handed steering
  - 360° heel turning – “palming”
  - Elbow steering
  - Finger steering
  - Knee steering



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Module 1

### SIGNALING YOUR INTENTIONS IN TRANSIT

- Signal before any change of direction
- Signal early
- 3 blinks before lane change
- Assure that your turn signal is off after the turn



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EYOC - Class B

Module 1

### TRAFFIC CONTROL DEVICES IN TRANSIT

- Stale green
- Stale yellow
- Flashing yellow means proceed with caution
- Flashing red means stop before proceeding
- Yield sign
- Stop sign
- Four-way stops



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EYOC - Class B

Module 1

## SAFE DRIVING PRINCIPLES

### PHILOSOPHY

We have adopted a philosophy concerning Emergency Vehicle Driving that will guide policy, procedures, training and accountability: *We drive our vehicles with the mindset that the other driver will make a mistake in the path of our vehicle. Our operators will drive proactively by adjusting their driving to avoid collisions triggered by other drivers, traffic, and environmental conditions.* Blaming other drivers, traffic conditions, weather conditions, or the need to speed in the name of emergency response is not acceptable. Our operators will drive professionally, which means proactively and with a self-imposed higher standard of care than other drivers. We will add twenty seconds to our response time to arrive on the scene safely. We will add a minute to safely deliver a patient to the hospital. Professional operators are smooth; and smooth is fast.

### RESPONSIBILITY OF OPERATING AN EMERGENCY VEHICLE

There is a great deal of responsibility placed on the operator of an emergency vehicle, both legal and moral. You have a legal responsibility to exercise “due regard” for the public when operating the apparatus. This means keeping the safety of others in mind when carrying out your duties. If you do not exercise due regard, you could be found guilty of negligence. Negligence is defined as “failure to use a reasonable amount of care when such failure results in injury to another.” An example of negligence would be driving too fast for conditions, thus leading to a collision. Gross negligence is reckless disregard of the consequences of acts to another person. Passing a red light at a high rate of speed and expecting the public to stop could be considered gross negligence.

A lawsuit against the fire department, or you personally, could have a devastating effect not only monetarily but in terms of loss of confidence and public respect. The inevitable publicity of a lawsuit has an adverse impact on how the community perceives its fire department and subsequently erodes public support. Lawsuits can also have political consequences causing elected officials to avoid publicly supporting the fire service.

Some of the moral implications of a negligent collision are just as important as the legal aspects. Apparatus involved in a collision usually does not arrive on a scene and certainly doesn't provide efficient service if it does arrive on scene. Consider the following potential consequences to an apparatus crash:

- Will an otherwise savable person perish because help didn't arrive in a timely fashion?
- Will fellow firefighters be injured, disabled, or possibly killed because of your failure to arrive?
- Will other roadway users suffer injury, death, property loss, and inconvenience?
- Will the apparatus be unavailable for service while it is being repaired or replaced, and at what cost?

- Will your job, promotional opportunities, or membership status be in jeopardy due to negligent actions?
- What are the short-term and long-term financial impacts on you and your family? What are the psychological costs to you?

These are some of the serious questions to consider before you climb behind the wheel of an emergency vehicle. You will be held responsible for your actions by the organization, your peers, the public, and your own conscience!

## **EMERGENCY VEHICLE DRIVING TECHNIQUES**

Certain exceptions to the driving laws are afforded to emergency vehicle operators to expedite their response and are located in Title 21 of the Transportation section of the Maryland Code. Generally, they include exceeding the posted speed limit, the ability to travel against the flow of traffic, proceeding against traffic control devices, and stopping or blocking roadways. During travel, the privilege to these exceptions is only granted when using audible and visual warning devices to request the right of way. All of these privileges are only to be exercised with due regard for the safety of the driving public.

### **Exceeding the speed limit**

Many factors determine the safe speed. Apparatus type and weight, weather, traffic, road surface, driver experience, posted speed limits, and sight distance are all considerations for vehicle speed. Posted speed limits are based upon good road conditions and weather, therefore they might be too high for conditions. MCFRS Policy states that 15 miles per hour over the limit should be the maximum allowed under the best conditions.

### **Rate of closure**

When approaching traffic ahead, the emergency vehicle operator must leave sufficient room to safely react and compensate for the actions of the civilian drivers. Rate of closure refers to the relative speed of both vehicles. For example, if the car ahead is traveling at 25mph and the apparatus at 35mph, the rate of closure is 10mph. If the car ahead is stopped, the rate of closure is a full 35mph. The apparatus operator should avoid closing this gap too rapidly and overtaking the vehicle ahead. Allow time for the other driver to perceive your presence and take the appropriate actions. When an emergency vehicle operator "tailgates" the cars ahead, trying to push them out of the way, there is no time or space to react to unexpected situations!

### **Travel against the flow of traffic**

This is a high-hazard practice that is sometimes deemed necessary to expedite the response. When responding the "wrong way" into oncoming traffic, you must proceed with a heightened awareness as the hazards are now multiplied. Remember that other drivers are not expecting to meet another oncoming vehicle in their lane. Expect them to be confused and potentially react in undesirable ways. You must remain especially aware of areas where sight distance is limited. Be ready to stop or leave yourself an out!

**Yielding at controlled intersections**

Exercising due regard requires that the operator of an emergency vehicle be able to yield the right of way at a red light or stop sign to avoid a collision and proceed only when the right of way is given by other vehicles. Recognize that civilian vehicles may have to choose between slamming on the brakes and risking a rear-end collision or rapidly passing through to clear the intersection. This requires the emergency vehicle driver to exercise great caution and patience. Move cautiously and meticulously into intersections, making eye contact with the other drivers whenever possible and predicting their action by the motion or "posture" of their vehicle. Assume that civilian vehicles that are still in motion do not see you and are not prepared to yield. Proceed only after you are clearly given the right of way. While trying to make your unit visible to approaching traffic avoid bullying your way through the intersection as this can create collisions. When crossing a multi-lane roadway approach *each lane* individually in the above manner. Multi-lane roadways provide opportunities for drivers to switch lanes to pass vehicles that are already yielding to you. Beware of empty lanes that offer civilian vehicles a free path to intersect with your route. Position your apparatus to be able to verify the status of open lanes before fully committing.

**Use of warning devices**

Using visual and audible warning devices is a request for the right of way. Title 21 of the Transportation section of the Maryland Code only grants special privileges to fire and rescue apparatus when the unit is using both audible and visual signals. Even at hours when the roads are empty you are legally obligated to request the right of way. Sometimes a late night/early morning run could be your most dangerous response. Party-goers returning home after an evening of socializing, overnight delivery people who are used to roads being clear, and fatigued drivers who might not be as alert as in the daytime are your driving companions. They all deserve to be properly warned.

Emergency vehicle operators should also avoid sounding warning devices *only* at intersections. This does not give motorists advanced notice of your approach and any plan they formulate will likely be based upon panic or fear.

If you are cancelled while enroute or the incident is downgraded, turn off the warning devices and drive like the rest of the public. There are no special privileges afforded to apparatus driving in routine mode.

**Focus your attention**

As the operator of an emergency vehicle, your job is to drive the apparatus to the destination (be it an emergency or the grocery store) and operate it properly. This should be your complete focus of attention. One of the first things you should be doing is mentally planning your route, considering impending traffic conditions, and the response routes of other apparatus to the scene. Use other crew members as a resource when uncertain of your route, the next turn, or positioning upon arrival. Avoid engaging in radio communication and casual conversation with other passengers. If activities in the cab are distracting you, express your concern to the rest of the crew. Full concentration should be devoted to driving.

Avoid removing your hands from the steering wheel to operate the siren, air horn, cell phone or radio microphone. It may also be best to avoid using your left foot to engage the foot pedals for warning devices if you find that distracting. Leave these duties to the person riding in the right front seat.

### Physical Preparations

There are aspects of vehicle operations that an apparatus operator can address *before an alarm is received*, not while the apparatus is responding. The vehicle features that can be adjusted for the operator must be adjusted while parked and not while the vehicle is driving down the road. These include the steering wheel, seat, and mirrors.

### Driving Tasks

**Starting** includes all pre-trip activities, as well as leaving the station, scene or parked position. Starting includes the daily apparatus check conducted at shift change, the pre-motion circle check, the cab adjustments, seat belt check and a visual scan of the field of view and departure path.

## Daily Apparatus Check or Pre-Trip

- ☐ Preventive maintenance process
- ☐ Occurs at shift change/driver change
- ☐ Identifies defects
- ☐ Treats small problems
- ☐ Mirror, steering wheel, & seat adjustments
- ☐ Documents vehicle condition and tracks defects or tendencies that may signal larger problems
- ☐ Mark of a professional operator



## Cab Adjustments

- ☐ Passenger mirror
- ☐ Driver mirror
- ☐ Steering wheel height and angle
- ☐ Seat height and position
- ☐ Clean windshield
- ☐ Clean windows
- ☐ Clean mirrors



Adjust blind spot mirrors to provide a view of the two blind spots.

## Circle Check

*Rapid 360-degree vehicle scan*

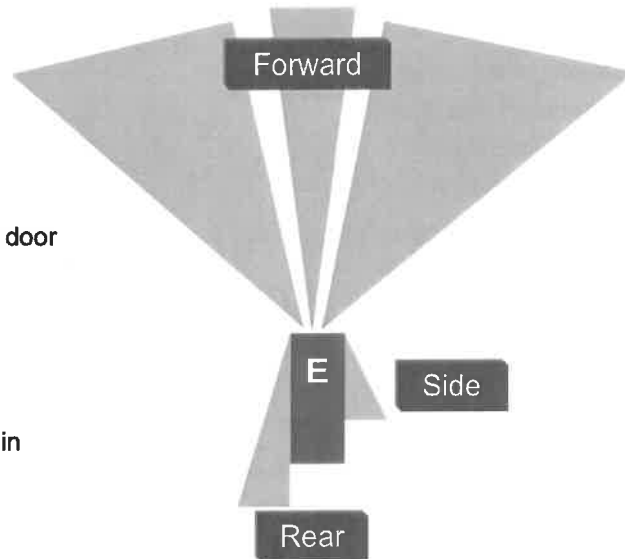
- ☐ Sides
  - ☐ Compartment doors
  - ☐ Ladders, tools, lights, and equipment
- ☐ Rear
  - ☐ Supply line and other hose
  - ☐ Appliances and loose equipment
- ☐ Underneath
  - ☐ Obstructions or forgotten equipment
  - ☐ Wheel chock
- ☐ Mark of a professional operator



Performed each time the vehicle is moved after personnel have dismounted or when leaving the station.

## Visual Scan

- ☐ Operator completes a visual scan before moving
  - ☐ Forward
  - ☐ Sides
  - ☐ Rear
  - ☐ Inside the cab
- ☐ Remain parked until the overhead door is 100% open
- ☐ Look in mirrors for open doors
- ☐ Proceed slowly through the door opening and hazard zone
- ☐ Beware of pedestrians crossing to mount other apparatus or walking in front of the station



## Seat Belts

- ☐ All crew members seated and restrained
- ☐ Seat belts drastically reduce the chance of being killed or seriously injured during a crash
- ☐ Patient care providers must use their judgment during patient transport
- ☐ EMS unit driver must adjust speed and space cushions when crew member is unrestrained
- ☐ Zero Tolerance. Consequences imposed



*In-motion* tasks are numerous and include maintaining space cushion, visual lead time, eye movement, “cover the brake”, safe speed, railroad crossing, steering, signaling and traffic signs and signals.

## **AUTOMATIC TRANSMISSIONS**

Most fire apparatus produced today are equipped with automatic transmissions. Some models have an overdrive gear, which allows the transmission to turn the drive shaft faster than the normal 1:1 direct drive. In direct drive, the drive shaft is turning the differential at or close to the governed engine rpm. In overdrive, the transmission gearing turns the drive shaft faster than the engine rpm. This feature allows the differential to be geared for a more powerful low-end performance while not limiting the high-end top speed.

Most transmission manufacturers recommend using “D” drive mode and allowing the transmission to shift through the gears automatically without driver inputs. Some apparatus require the driver to press the “mode” button to engage overdrive when driving at highway speeds. Drivers must learn how their specific vehicle is set up.

Automatic transmissions have enhanced operational safety, since the driver does not have to concentrate on clutch-and-shift procedures. They also allow the driver to keep both hands on the steering wheel at all times to maintain full control of the vehicle.

## **AIR BRAKE SYSTEMS**

Modern fire apparatus and many EMS units are equipped with a dual air brake system for safety. It has two separate air brake systems, primary and secondary, that use a single set of brake controls. One system typically operates the air brakes on the rear axle, and other on the front.

The vehicle’s air compressor will normally maintain between 110 and 120 psi in the air tanks. Before moving a vehicle with air brakes, you must allow time for the compressor to build up a minimum of 100 psi in both the primary and secondary systems. The apparatus might have two separate air gauges to indicate the pressure in the primary and secondary systems or a single gauge with two needles (red and green) to indicate the different systems. When the air in either system is below 60psi, the low air warning should engage. As the system air builds the low-air warning will stop, however it is still not safe to move the vehicle until both systems are up to 100psi or more.

If you are driving and the low air warning comes on, this is an indication that one of the systems has dropped to 60psi. In this situation, the front or rear brakes will not be fully operational. This is a dangerous condition that will increase stopping distance significantly. A failure to build and hold pressure in either system requires the driver to stop and safely park the apparatus until the nature of the problem is determined.

Air brake equipped vehicles typically have a “parking brake” function on the rear axle integral to the air brake system. This may also be referred to as the “spring brake.” Aerial apparatus may have additional parking brake functionality on the front axle to maintain braking while using stabilizers. Air brake systems have air chambers at each

braking wheel for the purposes of applying the service brakes. The parking brake function is accomplished by adding another chamber, thus having dual chambers, at the desired wheel.

Service brakes are applied when the driver depresses the foot pedal in the cab. The supply air enters the brake chamber at the wheel engaging the brake linkage to the brake assembly within the wheel.

Parking, or spring brakes, are applied when a control knob in the cab is engaged. Some apparatus have dual control knobs so one is within reach of the driver and the other the officer. They serve the same purpose. On axles equipped with parking brakes, a second air chamber contains a powerful spring held in a compressed state by air pressure when the parking brake is released. When the control knob in the cab is engaged, the air is exhausted from the brake chamber and the mechanical force of the springs applies the brakes. In this configuration, low air pressure in the system for any reason will result in automatic application of the spring brakes. The control knob, catastrophic air loss, or mechanical malfunction that results in a loss or inability to build air pressure are all ways the parking brake may engage. The parking brakes will not release until there is sufficient air pressure in the system to overcome the mechanical spring.

Apparatus manufactured since 1991 are equipped with an air pressure protection valve, which stops supplying air pressure to accessories such as air horns if the system pressure falls below 80 psi. This helps ensure that sufficient air pressure is maintained in the system to stop the vehicle and to prevent premature application of the spring brakes.

Some apparatus are equipped with a special emergency spring brake release system. This system maintains an isolated air tank that does not supply air to the braking system under normal conditions. If a leak in the air system causes the spring brake to apply, there is a possibility that the compressor will not be able to overcome the leak and the vehicle will be unable to move from the location where the brake was applied. If this occurs, the driver can press and hold the emergency release valve and the parking brake control at the same time to release the spring brake and move the vehicle out of traffic and off to the side of the road. This emergency release is only able to provide air for a short duration and should be used only to move the apparatus to a safe position.

## **AUXILIARY BRAKING DEVICES**

Auxiliary braking devices in the form of transmission retarders, driveline retarders, exhaust brakes, and engine brakes apply a slowing force to the drive wheels of the vehicle without the use of the service brakes. These devices prolong brake life by assisting with slowing or stopping the vehicle when used properly.

The timing and intensity of the forces exerted by auxiliary braking devices vary from device to device and sometimes vehicle to vehicle. All of them engage automatically in conjunction with another vehicle function, i.e. application of the service brake, releasing the accelerator, or a combination of both.

Each system has specific operating instructions that the apparatus operator should read and understand. Some of these instructions are particularly important and include disabling the device on slippery or wet road surfaces.

Turning the auxiliary braking systems off should be an exception and not the rule. Although it is important to turn some of these devices off in slippery weather, they should remain operational when traction is adequate. Auxiliary braking devices aid vehicle safety by bridging the reaction time it takes a driver to move their foot from the accelerator to the brake. In addition the reducing stopping distance, auxiliary braking devices help keep the service brakes cool, which increases their efficiency and reliability.

## **COLLISION AVOIDANCE**

Most collisions are caused by operator error. The error might be yours or it could very well be the other driver's. By driving defensively, you can reduce the probability of being involved in a collision. Keep in mind the following four concepts as you drive:

1. **Be alert.** Never think that the other driver will not make a driving error.
2. **Be prepared.** Learn what to do in any case when you have to act fast. Anticipate a problem before it happens.
3. **Act quickly.** Don't panic. Know what to do if something happens suddenly.
4. **Obey traffic laws.** The operator of an emergency vehicle is often exempt from certain traffic regulations while responding, but always with due regard for the safety of the driving public. When in a "routine" mode *always* obey *all* traffic laws.

## **Proactive Driving Formula**

The Proactive Driving Formula is applied repeatedly and frequently every time the apparatus is moved:

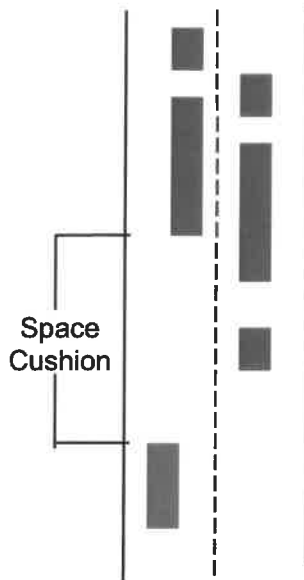
1. **Sense** the conditions.
2. **Identify** the hazard.
3. **Predict** the outcome.
4. **Decide** an action to take.
5. **Execute** the maneuver.

## **Defensive Driving**

The word "defensive" in this context means "preventing". Just as a defensive fire operation prevents the fire from spreading to the exposures or the defense of a sports team prevents the opponents from scoring, defensive driving techniques help prevent collisions.

A key component of defensive driving is maintaining a space cushion around your vehicle when driving. Maintaining a space cushion provides time to react to changing conditions. The space cushion also provides space to maneuver should an unforeseen

situation arise that cannot be avoided by braking. Most people think in terms of not “tailgating” (following the vehicle ahead too closely), but the space cushion needs to exist on all six sides of the apparatus (don’t forget the top and bottom).



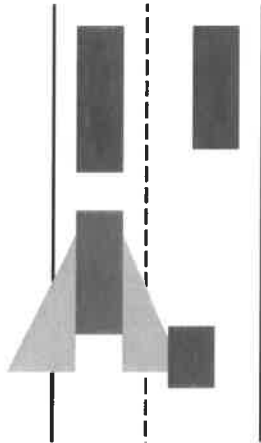
## Space Cushion

- ☐ Provides adequate space for braking
- ☐ Provides space for offensive or aggressive drivers
- ☐ Provides adequate space for decision-making and executing action

A space cushion in front of your vehicle provides two key advantages. First, you allow reaction time when vehicles in front of you begin braking. Your vehicle needs considerable space and distance to safely stop. Second, it provides space to see around the vehicles in front of you or identify road hazards that are otherwise hidden by vehicles ahead.

Having others travel in the space next to you presents two dangers. First, the other driver might change lanes suddenly and turn into you. Second, you may be trapped when you need to change lanes to avoid a collision. When a vehicle is driving next to you on the side, either adjust your speed or pass the other vehicle.

## Side Field of Vision



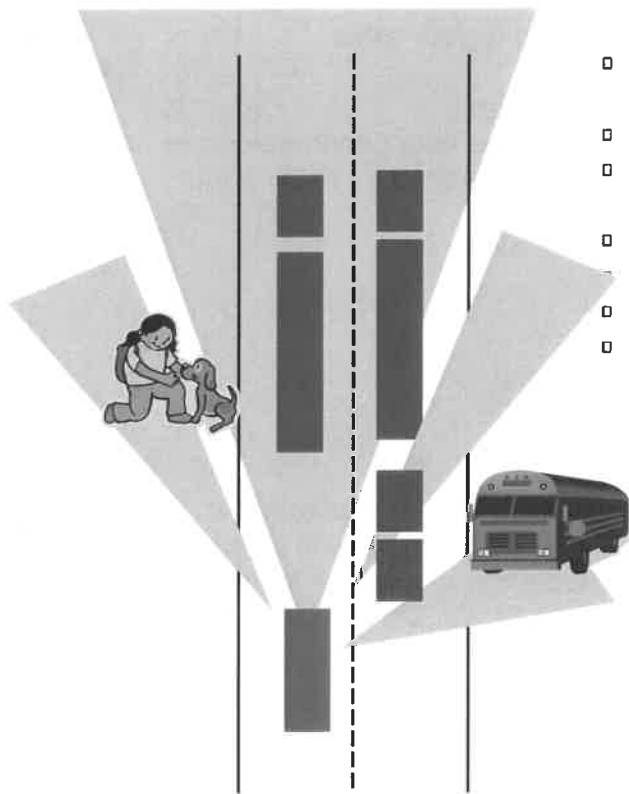
- ▣ See what is happening to your sides
- ▣ Use blind spot mirrors
- ▣ Monitor left and side lanes
- ▣ See what is about to enter your peripheral vision
- ▣ See aggressive drivers before they cut in front you

When passing other vehicles, keep the apparatus in the center of the lane to allow enough side clearance to pass safely. The best way to accomplish this is to look ahead down the road. You will naturally center the vehicle. Avoid trying to gauge the clearance by looking side to side.

“Talk” to other drivers by using your signals. Signal turns far in advance; if you anticipate braking, tap your brake pedal a few times to flash your brake lights before the actual stop is necessary. If possible, make eye contact with the other driver as a form of silent communication.

Look far enough ahead. Because stopping or changing lanes can require a lot of distance, you need to look well ahead to make sure that you have the room to make these moves safely. Most good drivers look 12 to 15 seconds ahead. At lower speeds, that is about one block. At highway speeds, it's about a quarter of a mile. A good driver will shift his attention back and forth, near and far.

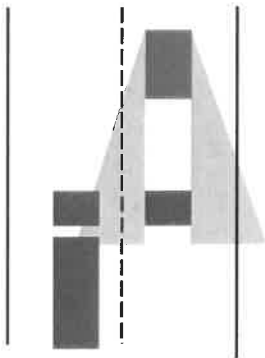
## Visual Lead Time (Forward)



- ▢ Scan the horizon and look over the vehicles in front of you
- ▢ Scan ahead and scan street sides
- ▢ Try to see what you will encounter 12 -15 seconds from now
- ▢ Helps vehicle stay in a straight line
- ▢ Identify hazards and still have time to react
- ▢ Intersections, crosswalks, RR crossings
- ▢ Playgrounds, schools, construction, parking lots, shopping centers

You should scan ahead 12-15 seconds. This will help keep your vehicle moving in a straight line and will allow you to take in the entire scene, including the side of the road. Watch for activities occurring on the side of the road.

## Rear Field of Vision



- ▢ Check your mirrors every 5 to 10 seconds
- ▢ You may see a vehicle approaching too fast or following too close
- ▢ You may still have time to react
- ▢ Check mirrors before slowing or changing your path

## Mirrors

### Other Times to Check Mirrors

- ☐ Check mirrors before slowing down, stopping, decelerating
- ☐ Check mirrors on long or steep hills
- ☐ Mirrors distort the real image
- ☐ Objects appear to be smaller and farther away than they really are



Another area of “space” to consider is overhead space. The driver of the apparatus, especially a taller unit equipped with an aerial device or a high rescue body, must constantly be aware of the vehicle’s overall height. Some departments routinely mark height information on the dashboard or windshield to serve as a reminder. NFPA 1901 has required a placard with the height of the apparatus for a number of years.

A problem sometimes encountered is that height marking on bridges and overpasses can be incorrect because of repaving or heavy packed snow. If you have any doubt about an overhead clearance, STOP and have a member of the crew check for adequate room. This is also true when apparatus “relocate” or “cover” other fire stations. Many times, especially in older fire stations, there is not adequate overhead clearance for modern, larger apparatus.

Low-hanging tree limbs can also cause serious damage to apparatus. On the rear-mount type of aerial unit, the driver must not only watch for the aerial or platform in the front to clear but must also be aware of the operating pedestal at the turntable, which usually is quite high. In an area where trees are routinely encountered, the driver should cautiously try to stay in the center of the road to avoid such hazards.

### Speed Control and Stopping Distances

Driving too fast is a major cause of fatal crashes. It is important to respond to emergencies in a prompt manner, but it is even more important to arrive safely. Adjust apparatus speed according to driving conditions. Conditions include traction of the road surface, curves, traffic, visibility, and hills.

**Total stopping distance = perception distance +  
reaction distance +  
braking distance.**

**Perception distance** is the distance your vehicle travels from the time your eyes see a hazard until your brain recognizes it. The perception time for an alert driver is about three-quarters of a second. At 55mph, you travel about 60 feet in this period.

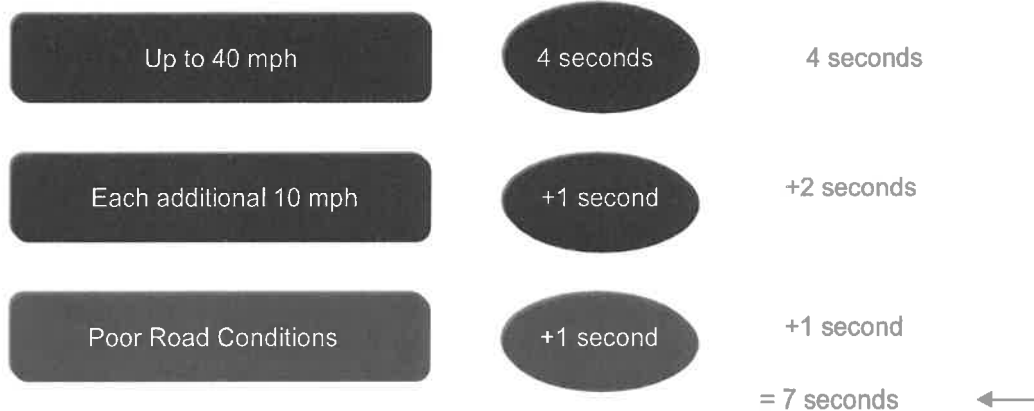
**Reaction distance** is the distance traveled from the time your brain tells your foot to move from the accelerator until your foot actually applies the brakes. The average driver has a reaction time of three-quarters of a second, which accounts for another 60 feet at 55mph.

**Braking distance** is the distance it takes to stop once the brakes are applied. A heavy two-axle truck at 55mph on dry pavement with good brakes can take approximately 300 feet to stop.

**Total stopping distance** at 55mph will be approximately 420 feet ( $60+60+300 = 420$  feet). Your vehicle will travel more than 1 ½ football fields before stopping!

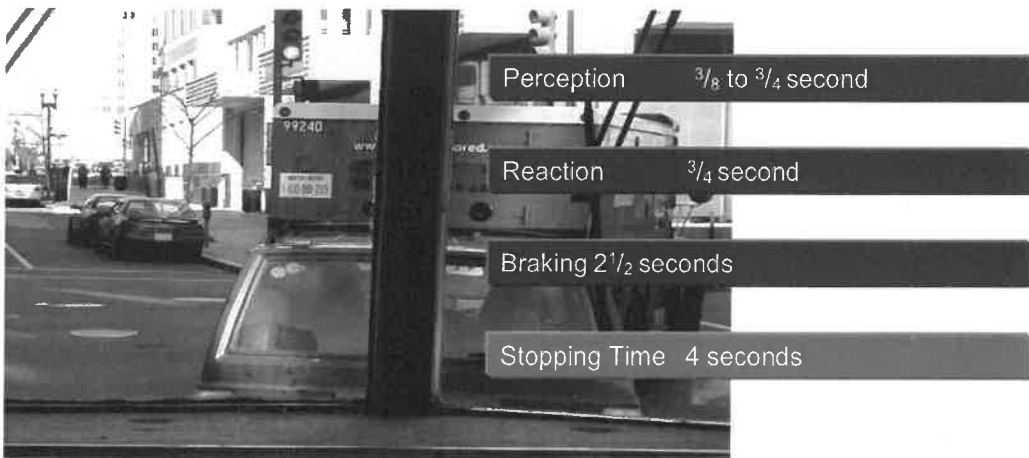
### Four Second Rule

What is an adequate space cushion for 60 mph on wet pavement?



Heavy apparatus and EMS units must use the Four Second Rule when traveling less than 40mph and under favorable conditions. If traveling over 40mph, then increase your space cushion by one second for each additional 10mph of speed over 40mph. In unfavorable conditions such as a wet road, add an additional 1 second to your space cushion.

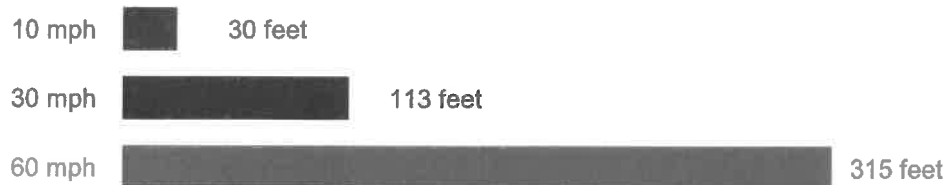
## Stopping Time



Based upon 40 mph on wet roads.

## Stopping Distance

How much distance do you need to stop on a dry road?



An adequate space cushion is critical. If you have an adequate space cushion using the Four Second Rule, then it is likely that you will have enough space to bring your vehicle to a complete stop. If you do not leave an adequate space cushion then you are at risk for a collision.

## Stopping Distance

Actual stopping distance on dry road (COF=0.70)

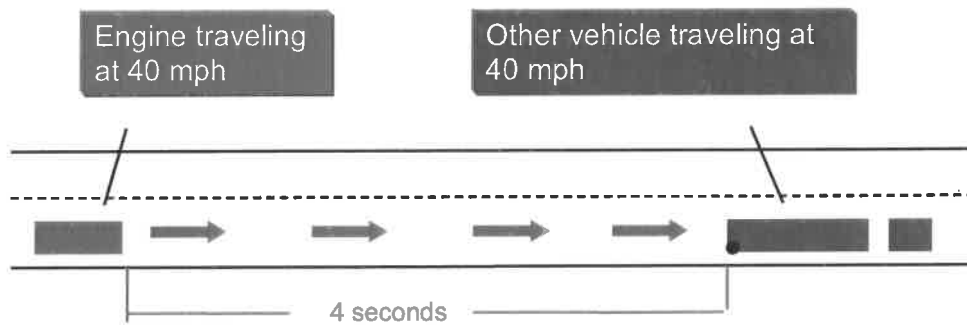
Miles/Hour	Feet/Second	Stopping Time (sec.)	Actual Stopping Distance (ft.)
60	90	3.5	315
40	60	3.0	180
20	30	2.5	75
10	15	2.0	30

## Stopping Distance

Actual stopping distance on wet road (COF=0.40)

Miles/Hour	Feet/Second	Stopping Time (sec.)	Actual Stopping Distance (ft.)
60	90	5.0	450
40	60	4.0	240
20	30	3.0	90
10	15	2.5	40

## Four Second Rule



- It should take the engine 4 seconds to pass the light pole.
- Add 1 second for each 10 mph over 40 mph.
- Add extra 1 second for poor conditions

To avoid collisions, you need to see what is happening in front of you, to your sides, and to your rear. A common at-risk tendency of emergency vehicle operators is eyes fixed on the forward path staring no more than 20-30 yards ahead. This is called tunnel vision and leaves the operator oblivious to the driving environment and leaves them little reaction time.

Understanding the effect of speed on stopping distance is extremely important. Whenever you double your speed, it takes about four times as much distance to stop, and your vehicle will have four times the destructive power if it crashes. By slowing down a little, you can reduce your braking distance significantly.

Weight is another important factor in stopping distances. The heavier a vehicle is, the more work the brakes must do to stop it. The combination of weight, speed, and frequency of brake application will cause the brakes to heat up.

The braking duty cycle of fire apparatus on a response is such that the friction in the braking system causes heat to rapidly build up in the brake block and drums. This excessive heat can cause a major loss of efficiency in the braking system by affecting the friction surface of the brakes and expanding the drum. Some estimate that brakes that heat more than 520°F lost 60 percent of their efficiency. This, of course, increases stopping distance dramatically. On a long downgrade, this results in brake fade. Disc brakes are somewhat less prone to fading, since they dissipate heat better than drum brakes.

## Matching Speed to Road Conditions

Traction between the vehicle tires and the road provides the means to steer and stop the apparatus. A driver must be aware of road conditions that reduce this traction and require special adjustments in speed and handling. For example, it will take longer to stop and be more difficult to steer without skidding when the road is slippery. To compensate, you obviously must drive more slowly to stop in the same distance as on dry pavement. A wet road will require slowing down by about one-third; on packed

snow, speed should be reduced by one-half or more. If the road surface is icy, speed should be reduced to a crawl.

*Posted speed limits are for ideal conditions*

- ☐ Do not go faster than the speed shown
- ☐ Slow your speed for less than ideal conditions
- ☐ Slow and smooth acceleration and stops
- ☐ Maintain adequate space cushions
- ☐ Your best defense is to SLOW DOWN



Sometimes the majority of the road will have adequate traction but certain areas will be extremely hazardous. The cautious driver will learn to identify these hazards in advance and prepare to compensate for them. Sometimes it's hard to know if the road is slippery.

The following are signs of possibly slippery conditions as well as other hazards that warrant speed reduction:

**Shaded areas.** Shady parts of the road will remain icy and slippery long after the sun has melted the open areas.

**Bridges.** When temperatures drop, bridges will freeze before the general roadway because of air circulating under the bridges and the earth retaining heat under the main portion of the roadway.

**Melting ice.** Slight melting will make ice wet. Wet ice is much more slippery than ice that is not wet.

**Beginning of rain.** Right after it starts to rain, the water mixes with the accumulated oil from other vehicles that is on the roadway. This causes the road surface to become very slippery. As the rain continues, the oil tends to wash away, becoming somewhat less of a hazard.

**Hydroplaning.** When water collects on the road surface, hydroplaning – a thin film of water forms under the tires, causing contact with the road to be lost – can occur. When the friction surface is eliminated, you may not be able to steer or brake. You can gain control by releasing the accelerator to slow the vehicle down and reestablish the friction surface. Avoid applying the brakes if the apparatus is hydroplaning. Hydroplaning is more likely to occur if tire pressure is low or the tire tread is worn. One of the functions of the grooves in the tire tread is to carry water away from the tire surface. If the tires are worn, they will not perform efficiently.

**Reduced visibility.** Fog, rain, smoke, and dark reduce visibility and require a reduction in speed. You should always be able to stop within the distance that you can see ahead. In fog and rain, use low-beam headlights day and night. Avoid “overdriving” the headlights (requiring more stopping distance than the headlights illuminate).

**Glare.** Glare from driving into the bright sun or from drivers in the oncoming lane with high-beam headlights on can cause temporary blindness. Avoid looking directly into the light. Slow down and look at the right side of the road until the hazard passes. Note that dirty windshields can add significantly to the glare problem.

**Curves.** Apparatus drivers must adjust their speed for curves in the road. If you take a curve too fast, two things can happen. First, the tires can lose their traction with the road surface, and inertia will cause the vehicle to continue on a straight path and run off the road. Second, if the wheels retain their traction, the high center of gravity can cause the apparatus to roll over. This is especially true of water tankers and tall aerial apparatus.

When approaching a curve, slow down to a safe speed before entering the curve and gently accelerate out. This will help you maintain control. Avoid braking while on a curve, as it is easier to lock the wheels and cause a skid when turning.

**Downgrades.** On steep downgrades, gravity plays a major role in causing the apparatus to gain speed. The driver must select the appropriate transmission gear before descending the grade to allow the engine to provide a braking effect and work with the vehicle brakes. Continuously applying the apparatus brakes will cause heating and brake fade. If steep grades are a routing part of your response area, the proper use of an auxiliary braking device such as a driveline retarder or engine brake is essential.

To avoid collisions, you need to see what is happening in front of you, to your sides, and to your rear. A common at-risk tendency of emergency vehicle operators is eyes fixed on the forward path staring no more than 20-30 yards ahead. This is called tunnel vision and leaves the operator oblivious to the driving environment and leaves them little reaction time.

## Eye Movement

**Eye Movement** means keeping your eyes moving to see the fields of vision. Scan the entire field every 10 seconds.

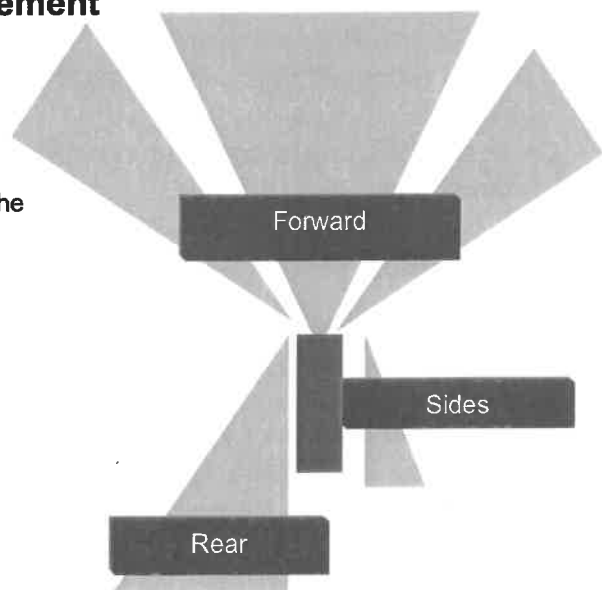
**Tunnel Vision** places your vehicle at-risk for a collision.

You need to monitor 3 fields of vision:

**Front** – at least ¼ mile ahead and street sides

**Sides** – lanes right and left next to vehicle

**Rear** – lanes right and left behind vehicle



## Railroad Crossings

Railroad crossings pose a serious threat to responding apparatus. There have been several cases in which apparatus were struck and firefighters were killed while crossing railroad tracks, especially at rural, unprotected crossings. Trains often approach at high speeds and are unable to stop for a vehicle on the tracks. They are required to sound their horn when approaching a grade crossing, but it might be impossible to hear it with the apparatus warning devices operating.

Another problem could be the grade of the roadway at the crossing. If the crossing has a steep approach and the angle of approach or departure on the apparatus (front and rear overhang) or underbody clearance is not sufficient, the vehicle could get hung up on the tracks.

When approaching a railroad crossing, DFRS Policy 808 requires you to stop, shut off all audible warning devices, look and listen, especially at unguarded crossings. You should not rely solely on the presence of warning gates or signals to warn of approaching trains. Be aware of double tracks, where a train passing in one direction might hide a train on the other track. When you are sure that it is safe, proceed all the way across the tracks. Never permit traffic to trap you into having to stop on the tracks.

Never attempt to race a train to a crossing or pass lowered gates; it is extremely difficult to judge the speed of an approaching train.

### Railroad Crossing

- ☐ 808 requires you to stop at unguarded crossings.
- ☐ Stop and look in both directions.
- ☐ Assume that guarded signals are not working.
- ☐ Trains travel in both directions
- ☐ Wait a moment to proceed after a train passes.
- ☐ Assure the tracks are clear in both directions.



Stop for all railroad crossings

## City Driving

Speeds are usually much lower in city driving situations, but there are many more things to watch for and more driving tasks to attend to. The operator must constantly watch for the movement of others. Pedestrians, motorcycles, and small children are more likely to create a problem in city driving situations. When traffic is heavy, you'll need extra time to react. By keeping speeds low, you can gain valuable time.

**Intersections** are undoubtedly the most hazardous locations during an emergency response. When approaching an intersection, there are several considerations for the driver:

1. Is there a traffic light or stop sign that controls the intersection? What is the signal that controls my approach? Uncontrolled intersections, where there are no lights or signs, can be especially dangerous.
2. Reduce speed when approaching the intersection, even if you have a green light or the right of way at a stop sign intersection. "Cover" the brake pedal – rest your foot on it – ready to apply the brakes, if necessary. This greatly reduces reaction time if a brake application is necessary.
3. If you have a red light or stop sign, STOP. Do not "roll through" an intersection where the controls are not in your favor.
4. Look left, right and left again before proceeding. Look for other apparatus or other emergency vehicles that might be approaching from another direction. Cross one lane at a time and only after all lanes of traffic can be identified.
5. Look for pedestrians in the crosswalks, especially small children who may be difficult to see near parked cars and who might not be paying attention.
6. Avoid relying completely on traffic pre-emption devices. These units change the traffic signals in favor of the responding apparatus. Often, a motorist will see the green traffic signal he waited for change quickly back to red and think that the traffic light control is malfunctioning. An impatient person might proceed anyway.
7. Change the pitch and tone of your siren before you approach the intersection. Going from wail to yelp and sporadically sounding the air horn might attract the attention of other motorists who might be in relatively soundproof cars.
8. If turning at an intersection, be aware of the space necessary to safely clear parked and oncoming vehicles. Signal your intentions as you approach. When turning left across traffic, allow all oncoming traffic to come to a stop. Try to make eye contact with the other drivers. When turning right, stay in your lane to prevent another motorist from trying to pass on the right. As you enter the intersection, go far enough past the corner to safely make the right turn without contacting the parked cars. If this maneuver takes you into the cross street traffic lane, stop and wait for clearance to proceed.
9. Avoid reliance of well-intentioned civilians "directing traffic" at intersections. Approaching traffic may not obey the person's commands, which will create a serious hazard for the apparatus operator who think that the intersection is secure.
10. The apparatus operator must come to a complete stop when encountering a stopped school bus with warning lights flashing. Also, observe reduced speed zones around schools.

## Highway Driving

While the potential for collisions is great in city driving, many traffic collisions and fatalities occur on the highways when the weather is good and the roads are dry. In most cases, speed is a major cause and often results in fatal collisions. The open spaces of the highway often lead to the driver's relaxing his attention. You must stay alert, keep your eyes moving, and be ready to react to the unexpected.

When entering a highway or freeway, attempt to match your speed to that of the traffic flow and blend in. Avoid slowing down quickly in traffic lanes. Drive at the speed of traffic, and keep a safe following distance.

At highway speeds, it is often impossible for a driver ahead to hear apparatus warning signals. In this case, a greater reliance is placed on visual warning devices. This sometimes takes longer, as the driver is not likely to notice the apparatus – and take appropriate action – until he checks his rear-view mirror. The apparatus operator must be aware of this and void “chasing” the vehicle in front. If drivers suddenly see a large fire apparatus directly behind them they may panic and apply the brakes. At highway speeds, this could easily result in a rear-end collision. Always leave that “cushion” of space around your vehicle.

## Signaling

- ☐ Signal before any change of direction
- ☐ Signal early
- ☐ 3 blinks before lane change
- ☐ Assure that your turn signal is off after the turn



Signal early

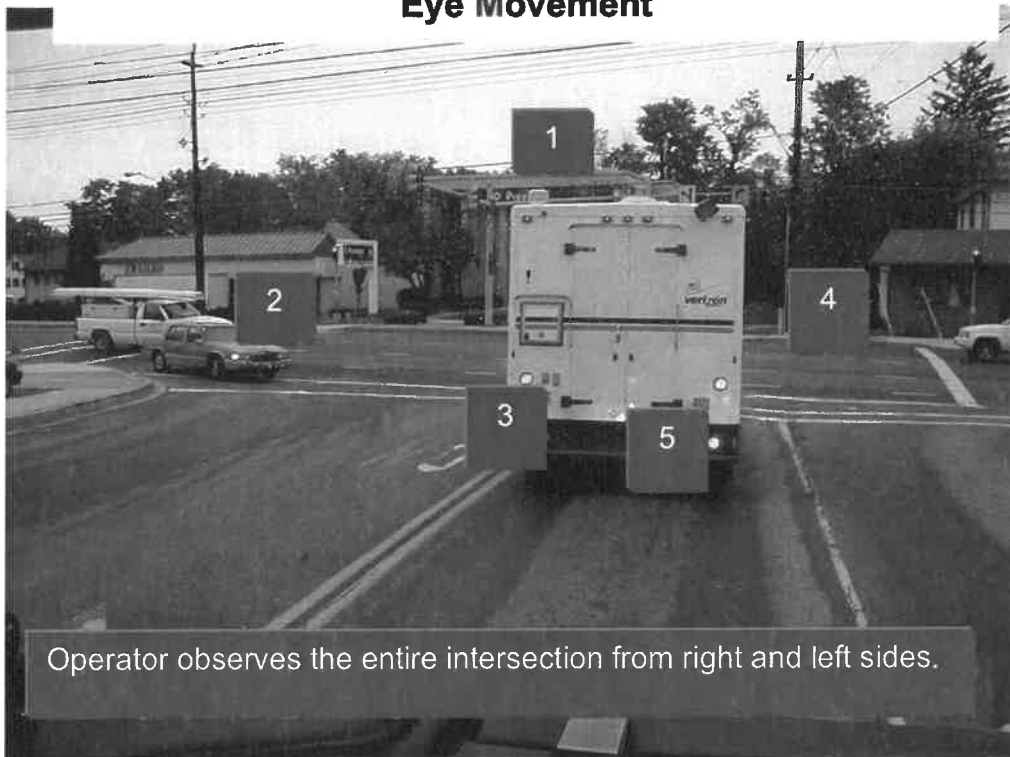
## Cover the Brake

Covering the brake is an excellent proactive driving technique for approaching, entering, and traveling through intersections. Covering the brake means that you remove your right foot from the accelerator pedal then shift your foot to the brake pedal placing it in braking position thus reducing your reaction time in the event of an emergency stop.

- ☐ Cover the brake when you identify a probable hazard
- ☐ Approaching, entering, or traversing intersections
- ☐ Remove foot from accelerator and prepare to brake
- ☐ Advantages
  - ☐ Immediately decreases speed
  - ☐ Braking distance decreases
  - ☐ Reduces reaction & braking times
  - ☐ Resume speed without losing momentum

Eye movement is critical while traversing intersections, especially during responses and patient transports. Your eye movement should follow the sequence in the photo below. What hazards exist? Who has the right-of-way according to the traffic light? What path should the operator take?

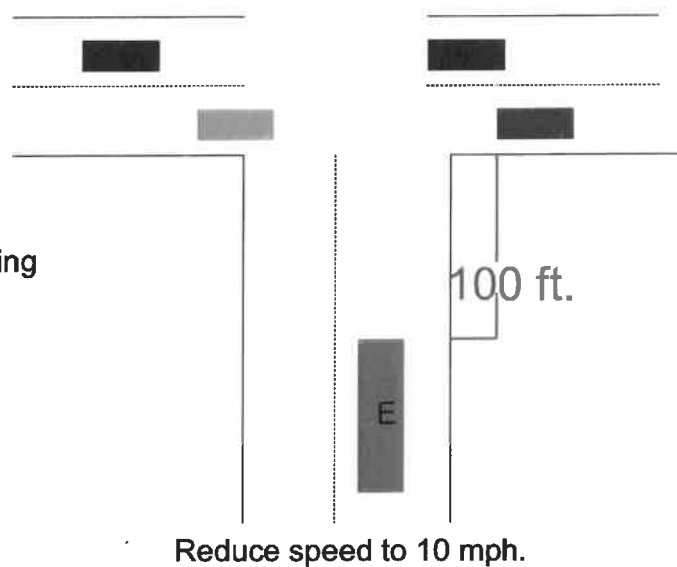
## Eye Movement



## Stopping at a Controlled Intersection

### Reduce Speed

- ❑ One of the best proactive driving tactics is to reduce speed
- ❑ Reduces stopping distance needed
- ❑ First gear or 10 mph no less than 100 feet before the intersection
- ❑ Achieves stopping distance < space cushion



Most collisions do not occur when vehicles are traveling in the same direction at similar speeds. Most collisions do occur when the vehicles are traveling in different directions at different speeds. Intersections are high-risk areas because both of these hazards are present.

### Intersection

- ❑ Must be prepared to stop at a red light, stop sign, or other intersection when you are against the right of way
- ❑ Account for each lane as a separate intersection
- ❑ Avoid using the apparatus as a moving roadblock – this is aggressive driving



You must be prepared to stop at intersections against the right of way.

### Jumping

- ❑ Operator depresses the accelerator hard from stopped position
- ❑ Vehicle jerks or jumps forward
- ❑ Hard on the apparatus
- ❑ At-risk for rear-end collision
- ❑ Jumps before other vehicle moves forward is a common low speed, at-fault collision
- ❑ Smooth starts

Avoid “Jumping” – a common cause of slow speed, rear-end collisions. “Jumping” is when the operator depresses the accelerator hard from a stopped position causing the apparatus to jerk or jump forward. “Jumping” is an at-risk behavior and in addition, can be very hard on the apparatus.

## Clear Space

- ☐ Space cushion left while stopped
- ☐ Clear space equals one-half of your vehicle length
- ☐ Helps prevent low speed rear-end collisions
- ☐ Adequate room to change lanes



Clear space left for maneuvering.



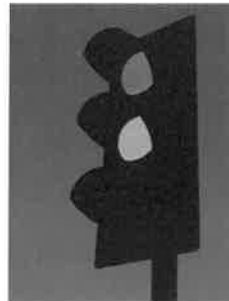
Too close. No room to maneuver right or left.

Leaving a Clear Space is another proactive driving technique for intersections. A Clear Space is simply a space cushion that you leave when you are not in motion. An adequate Clear Space is measured from your front bumper to the rear of the vehicle in front of you.

## Traffic Lights

### *Pay attention to traffic lights*

- ☐ Stale green
- ☐ Stop for yellow
- ☐ Flashing yellow means proceed with caution
- ☐ Flashing red means stop before proceeding



## Traffic Emergencies

A traffic emergency occurs when a vehicle is about to collide with a fixed object or another vehicle. Your chances of avoiding a crash depend on how quickly and effectively you act.

Stopping is not always the safest thing to do in an emergency. When you don't have enough room to stop, you may have to steer away from what's ahead. You can almost always turn to miss an obstacle more quickly than you can stop.

**Evasive maneuver.** To exercise an evasive maneuver, you must firmly grip the steering wheel with both hands. Most authorities agree that the best hand position is between 9 and 10 o'clock for the left hand and between 2 and 3 o'clock for the right. The best way to be prepared for an emergency is to have your hands in this position the whole time you are driving. Avoid gripping the spokes of the steering wheel or "palming" (steering with the palm of the hand) the wheel with one hand.

You can make a quick turn safely if you perform it properly.

- Do not apply the brakes while you are turning. This could cause wheel lockup and the vehicle could skid out of control.
- Do not turn any more than needed to clear whatever is in your way. The more sharply you turn, the greater the chances of a skid or rollover.
- Be prepared to "counter-steer" – that is, to turn the wheel back in the other direction once you've passed whatever was in your path. Unless you prepare to counter-steer, you won't be able to do it quickly enough. You should think of emergency steering and counter-steering as two parts of one section.
- Keep both hands on the wheel. You can make a very aggressive turn if the steering wheel is rotated 180° (when your forearms are crossed and touching). Returning requires that you aggressively pull back the wheel as well.

Deciding in which direction to steer is determined by the hazard you are trying to avoid and whether the cushion of space is present around your vehicle. If an oncoming driver has drifted into your lane, going to the right would be the best decision. If the other driver realizes what has happened, his natural response would be to return to his own lane.

If something is blocking your path, such as an object's falling off the vehicle in front of you, the move could be to the left or right if the lanes are empty. If you are properly using your mirrors and keeping the space next to you clear, you should know which way to steer. If you are driving in the right lane on a road with a shoulder, going to the right would probably be the best move. It is unlikely that anyone would be driving on the shoulder next to you.

**Leaving the road.** In some emergencies, it might be a better decision to drive off the road rather than face a collision with another vehicle, especially head-on. If you do leave the road, try to avoid braking until your speed has slowed down. Brake gently to avoid skidding on the loose surface. Keeping one set of wheels on the pavement will help maintain control. After coming to a complete stop, check your mirrors, signal your intentions, and pull back on the road.

If one set of wheels drops off the pavement unexpectedly and you must return to the road before you are able to stop, use the following procedure:

- Always wear your seatbelt.
- Do not panic.
- Get control of your speed.
- Maintain control of the steering wheel.
- Steer straight ahead and slow down.

- Take your foot off the accelerator, but do not brake.
- Allow the vehicle to slow down on its own.
- When you reach a slow, safe speed, turn the steering wheel to the left and gently steer the vehicle back onto the highway one wheel at a time.
- Do not jerk your steering wheel.

**Controlling steering while braking.** When someone suddenly pulls out in front of you, your natural response is probably to rapidly apply the brakes. This is a good response if you have left enough space in the front of you for the brakes to stop the vehicle safely!

When braking, you should be able to slow the vehicle down while keeping it in a straight line and still maintain steering control. With conventional brakes, there are two techniques to accomplish this: controlled braking and stab braking. Controlled braking is applying the brakes as hard as you can without locking the wheels. If lockup is detected, release the brakes to regain control, and apply again. Stab braking is applying the brakes all the way, then releasing them when they lock, then fully applying them again – basically “pumping” the brakes.

Simply jamming on the brakes of a vehicle that is not equipped with an anti-lock braking system (ABS) will cause the wheels to lock up and result in a skid. If the apparatus is in a skid, there is no rolling friction between the front tires and the road, and you cannot steer the vehicle.

## Steering

- ☐ Hold steering wheel firmly
- ☐ Two hand skill
- ☐ Hands positioned at 3:00 and 9:00
- ☐ At-Risk Behaviors to avoid:
  - ☐ One-handed steering
  - ☐ 360 heel turning
  - ☐ Elbow steering
  - ☐ Finger steering



Hands grip steering wheel at 3:00 and 9:00

**Anti-lock braking systems** automatically apply and release the brakes (up to five times per second) when wheel sensors tell the computer that a wheel lockup has occurred. On an ABS-equipped vehicle, apply FIRM STEADY PRESSURE TO THE BRAKE PEDAL and allow the computer to “pump” the brakes as necessary. The driver’s pumping the brakes only confuses the ABS computer and increases stopping distance.

**Skid control.** A skid happens whenever the tires lose their grip on the road surface. This can be caused in one of four ways:

- **Overbraking** – braking too hard on a non-ABS-equipped vehicle, causing the wheels to lock up. This situation can also occur when an auxiliary braking device (engine brake or retarder) applies stopping power under slippery conditions.
- **Oversteering** – rapidly turning the wheels more sharply than the vehicle can turn.
- **Overacceleration** – supplying too much power to the drive wheels, causing them to spin.
- **Driving too fast** – the reason for most serious skids.

The most common type of skid is one in which the rear wheels lose traction because of excessive acceleration or braking. Excessive acceleration skidding causes “fishtailing” – the rear of the apparatus moves side-to-side – and is easily corrected by reducing acceleration.

Rear-wheel braking skids occur when the rolling traction of the rear wheels is lost because of brake lockup. The rear wheels then slide sideways in an attempt to “catch up” with the front, causing the apparatus to spin out or swap ends. To correct this condition, stop braking immediately to regain the rolling friction. Quickly steer in the direction that the rear is sliding toward. As soon as the vehicle is back on course, counter-steer in the opposite direction to bring it under control. This, like the evasive maneuver, must be done as one action, steer/counter-steer. ABS can help eliminate skids caused by excessive braking or the action of an auxiliary braking device.

Front-wheel skids are usually caused by driving too fast for conditions, worn tread on front tires, or brake lockup. In a front-wheel skid, the front wheels tend to go in a straight line regardless of how much you turn the steering wheel. On a very slippery surface such as ice, you may not even be able to steer around a curve. The way to deal with a front-wheel skid is to allow the apparatus to slow down without excessive braking or turning. The tires must be able to continue turning to regain the rolling friction necessary to steer and maintain control.

It should be obvious that most skids are caused by operator error. When the road surface is slippery, slow down; exercise due caution; and avoid making abrupt steering, braking, or acceleration maneuvers.

**Tire failure.** In the event of a tire failure, do the following:

- Be aware that a tire has failed.
- Hold the steering wheel firmly.
- Do not apply the brakes.
- After stopping, check all tires.

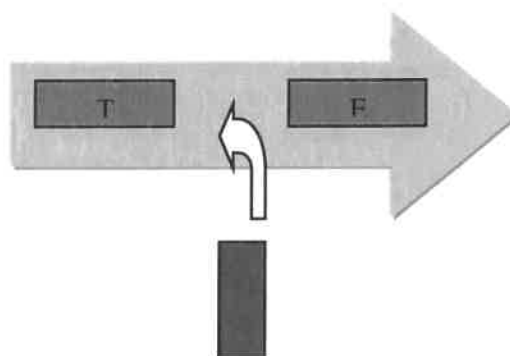
You can recognize several signs of tire failure and have time to properly react; the loud “bang” of a blowout, sudden vibration or “thumping”, and “heavy” steering, to name a few. When any of these indicators are present, hold the steering wheel firmly with both hands. A front-tire failure can twist the steering wheel out of your hands.

Avoid braking unless you are about to hit something. It’s a natural reaction to brake in an emergency; however, sudden braking with a failed tire could cause loss of control. Allow the vehicle to slow down, apply the brakes gently, and pull off the road.

After you have come to a stop, check all tires for signs of failure. The inside tire of rear "duals" might have to be bumped with a solid object to detect a flat. If the result is a sharp bounce, the tire is probably okay. If it is a dull "thud", the tire is flat.

### Zone of Confusion

- ❑ Created by two or more emergency vehicles responding together
- ❑ Civilian driver sees one emergency vehicle, but hears a different one at the same time
- ❑ Civilian driver thinks the coast is clear but pulls into your path
- ❑ Elderly and teenagers
- ❑ High-risk situation
- ❑ Anticipate other vehicles to make mistakes



Confused driver sees the Engine and hears the Truck. Driver's mind thinks there is only one emergency vehicle so driver pulls into the path of the trailing vehicle.

- ❑ Anticipate other drivers to make mistakes
- ❑ Demonstrate care for other vehicles
- ❑ Driving tactics for procession style response:
  - ❑ Travel single file. A larger vehicle leads. Leading vehicle creates a path.
  - ❑ Increase space cushions. NEVER travel nose to tail.
  - ❑ Each vehicle must traverse intersections alone and make eye contact with other drivers. Trailing vehicles NEVER bust the intersection.
  - ❑ Use contrasting siren tones. Switch to electronic siren with alternating or pulsing tone.

A "Zone of Confusion" can be created when two or more emergency vehicles are responding with lights and sirens. This confusion is created from a civilian seeing one emergency vehicle but hearing another. They may see one piece of apparatus go through an intersection and assume it is then clear to proceed through the intersection.

This "Zone of Confusion" is often created when an apparatus procession is traveling together or different emergency vehicles approach the same intersection from different directions. Anticipate that other drivers may make mistakes in your path. Adjust your space cushion and speed for the other drivers' mistakes.

## Deceleration

- ☐ Important skill for heavy apparatus and EMS unit operators
- ☐ Hard stops
  - ☐ Harsh on apparatus, equipment, crew, patient
  - ☐ Indicates operator was not scanning ahead
- ☐ Smooth deceleration stops
  - ☐ Plan ahead
  - ☐ Good visual lead time – ¼ mile ahead
  - ☐ Pick your stopping point on horizon
  - ☐ Decelerate early

## Stop at the Address

- ☐ Common at-risk driving behavior is passing the address
  - ☐ U-Turns in traffic
  - ☐ Backing against traffic
  - ☐ Operator gets frustrated
- ☐ Preplan & teamwork
- ☐ Know block numbers
- ☐ Know the cross street before the target block
- ☐ Reduce speed on the target block
- ☐ Use spot lights
- ☐ Stop and read the map book

## Spotting

Consider these good habits when positioning or parking

- ☐ Approach the final spot slowly
- ☐ Spot for tactical advantage
- ☐ Leave clear space around vehicle
  - ☐ Compartment doors
  - ☐ Walking paths
  - ☐ Outriggers
- ☐ Drive out instead of back out
- ☐ Leave access for incoming companies



## Parking Brake

Set the parking brake before personnel dismount the vehicle.  
It is good practice to set the parking brake when the vehicle is stopped for 10 seconds or longer in a non-driving situation.

## Wheel Chock

- ☐ Redundant parking brake
- ☐ Downhill side
- ☐ Required for parked vehicles either attended and unattended
- ☐ Light vehicles can use parking brake
- ☐ Turn wheels toward curb
- ☐ Mark of a professional operator



Chock a wheel

## Backing Up

One of the most hazardous times while driving is when backing up, because the driver cannot see where he intends to go. The mirrors can only give the driver a view of what is next to the apparatus and not directly behind. Many "first-due" police cars have been damaged when parked directly behind apparatus at fire scenes!

DFRS Policy 808 requires that spotters who maintain eye contact with the driver be positioned behind the apparatus before attempting to back up the unit. If guides are unavailable, the driver must set the parking brake, dismount the apparatus, and walk around to be sure that there are no obstructions behind. Circling the apparatus clockwise and returning to the driver's seat will ensure that there are no obstructions of any side of the vehicle.

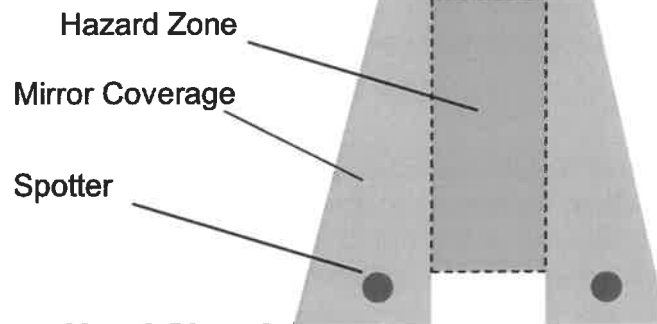
If possible, back the rear of the apparatus toward the drivers' side. It is much easier to see obstructions than when attempting to back in on the (right) "blind side". A better option, if possible, is to avoid backing up altogether and drive forward around the block.

## Safe Backing Tips

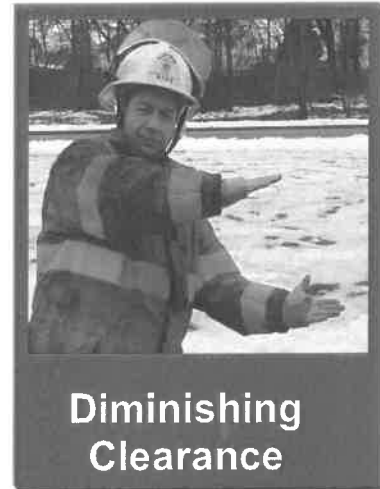
- Avoid backing.
- Back up when you first arrive at your location.
- Back up in a straight line.
- Always use a spotter.
- Stop immediately if you lose eye contact with your spotter.

## Safe Spotting

Spotters position themselves outside the rear hazard zone. The operator should stop the vehicle if the spotters are not visible or lack eye contact with the mirror.



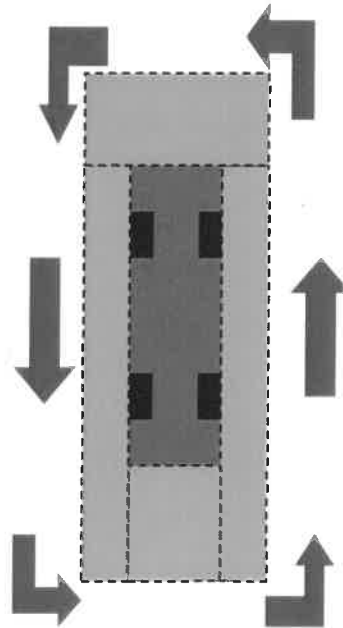
## Hand Signals



These standard hand signals should be used to communicate with the driver.

## Circle Check

- ☐ 360 degree inspection around the vehicle
- ☐ Observe the rear blind spot
- ☐ Observe the vehicle sides
- ☐ Note object positions
- ☐ Check overhead clearance
- ☐ Check underneath the vehicle



## Remember....

The easiest way to prevent a backing collision is to back with a spotter.  
If a spotter is unavailable, then complete a circle check.





# POLICIES AND PROCEDURES

## MONTGOMERY COUNTY

### DEPARTMENT OF FIRE AND RESCUE SERVICES

NO. 808

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June 9, 1994

TITLE


SAFE EMERGENCY VEHICLE OPERATION

DIRECTOR APPROVAL

#### PURPOSE

- 1.0 To provide Department of Fire and Rescue Services employees with general driving and safety regulations for operating emergency vehicles.
- 1.1 To reduce injuries and property damage by establishing standard procedures to avoid vehicle collisions.
- 1.2 To incorporate the general driving rules and regulations promulgated by the State of Maryland, DFRS, and Fire & Rescue Commission into a single policy.

#### APPLICABILITY

- 2.0 All DFRS employees in the Fire Protection Occupational Series.
- 2.1 DFRS employees qualified to drive emergency vehicles.
- 2.2  This policy was developed in cooperation with International Association of Firefighters Local 1664.

#### DEFINITIONS

- 3.0 Driver - Employee qualified to drive and/or operate emergency vehicles. May also be referred to as an operator.
- 3.1 Emergency Response Driving ("Responding") - Proceeding to an incident after dispatch by the ECC, or after notifying ECC, using audible and visual emergency warning devices.
- 3.2 Routine Driving - Proceeding through traffic, obeying all posted speed and traffic devices, without using audible and visual emergency warning devices. "Routine Driving" is the response mode for routine service calls.
- 3.3 Supervisor - The unit officer, station officer or other person responsible for overseeing employees.



# **POLICIES AND PROCEDURES**

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**DIRECTOR APPROVAL**

*[Signature]*

#### **POLICY**

- 4.0 The Department of Fire and Rescue Services will provide standardized rules and regulations to increase safety and reduce injuries and property damage while operating emergency vehicles.
- 4.1 Drivers and officers must not drive or knowingly permit a vehicle to be driven in an unsafe manner.
- 4.2 Apparatus must be operated in accordance with all traffic regulations when not responding to an emergency incident.
- 4.3 Drivers must operate vehicles in a courteous and professional manner at all times with regard for the best interest of the public and the fire and rescue service.
- 4.4 Personnel not confident in operating vehicles should request additional training or practice.
- 4.5 Drivers must not knowingly drive and/or operate a vehicle with mechanical defects that could affect the safety of its operation. Supervisors must be notified immediately when drivers determine a vehicle is unsafe to drive. Conflict between the driver and supervisor regarding the safety of the vehicle must be referred to the on-duty shift captain. The on-duty shift captain has the final determination and may order the driver to drive the vehicle.
- 4.6 All DFRS personnel must possess a valid motor vehicle operator's license of appropriate class to drive emergency vehicles.
- 4.7 Any employee whose license has been changed, revoked, suspended or otherwise disqualified must immediately notify his/her supervisor and refrain from operating motor vehicles.
- 4.8 Employees must notify their supervisor immediately of a conviction for any moving violation.



# **POLICIES AND PROCEDURES**

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*[Signature]*

- 4.9 Any employee who is suffering from a physical condition or taking medication that would adversely affect his/her ability to safely operate a motor vehicle must notify a supervisor immediately and refrain from driving. The Supervisor must evaluate the employee's fitness for duty and take action as needed. (See Policy #809, Substance Abuse Testing and Rehabilitation.)
- 4.10 Vehicle operators must exercise the principles of defensive driving at all times.
- 4.11 Provisions of this policy do not relieve vehicle drivers from exercising due caution for the safety of all persons.
- 4.12 Provisions of this policy do not protect drivers from the consequences of a reckless disregard for the safety of others.

## **RESPONSIBILITIES**

5.0 DFRS drivers are responsible for:

- a. safe vehicle operation at all times;
- b. striving to eliminate their own driving errors and making allowances for the lack of skill or improper driving actions of other drivers;
- c. adjusting their own driving to compensate for unusual weather, road and traffic conditions, and to avoid being led into an accident by the unsafe actions of pedestrians or other drivers;
- d. being alert to accident-producing situations; recognizing the need for preventive action in advance; and taking the necessary precautions to prevent accidents by knowing when to slow down, stop, or yield the right of way to avoid involvement;
- e. complying with all procedures set forth in this policy;
- f. obeying all applicable traffic and motor vehicle laws of the State of Maryland; and



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g. operating their vehicle, and are accountable for their actions.

5.1 The unit officer is responsible for ensuring that the vehicle is operated in a safe manner and in accordance with all applicable laws, ordinances and regulations.

5.2 All supervisors are responsible to see that these procedures are followed and that personal safety is assured by proper training and supervision.

#### **PROCEDURE**

6.0 Drivers must reduce the speed of the vehicle at all intersections to negotiate a full stop when the intersection cannot be safely entered. The vehicle must be under complete control and driven at such a speed that it can be safely stopped to avoid an accident should another vehicle enter the intersection. Emergency vehicle drivers must anticipate the need to yield to any vehicle already in any part of the intersection when responding against the red light. Emergency vehicle drivers must realize that they may be required to yield the "right-of-way" to the other driver to avoid a collision.

6.1 Operators must strive to maintain a minimum safe following interval of at least three seconds between units at all times.

6.2 Operators must never drive at night at a speed greater than that which will permit the vehicle to come to a stop within the forward distance illuminated by the vehicle's headlights.

6.3 Pedestrians must always be given the right of way.

6.4 Vehicle operators must drive in a manner to accommodate the unpredictable of other drivers.

6.5 All DFRS drivers must be aware of clearances and vehicle height. Tight clearance situations must be avoided whenever possible. When tight clearance situations are encountered, the officer must dismount and guide the driver.



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6.6 To avoid contact with overhead doors, vehicle operators must never:

- a. move the vehicle into an overhead door opening when the door is still moving up or down;
- b. stop or park a vehicle in an overhead door opening;
- c. activate an overhead door when a vehicle is in the door opening; and
- d. activate an overhead door from any position which precludes full view of the vehicle and the door either by the activating party or an observer.

6.7 Vehicle operators must be aware of the height, weight and ground clearance limitations for their vehicles.

6.8 Vehicles may be parked in fire lanes or other unconventional spaces during emergency incidents or during fire prevention activities when other spaces are not available. Designated parking spaces must be used at all other times. Designated parking spaces should be vacated as soon as possible.

6.9 Emergency vehicles emerging from an alley, driveway or building must stop immediately prior to driving onto a sidewalk or roadway and must yield the right-of-way to pedestrians and other vehicles.

6.10 Drivers must back their vehicles safely. The unit officer must dismount to the rear of the apparatus to provide backing direction. The officer must be positioned at the rear of the apparatus on the driver's side and establish visual contact with the driver. If eye contact is lost between driver and officer, the driver must stop until eye contact is re-established. The officer may direct an additional person to assist and guide the driver from a second position. The use of operator's aids does not relieve the driver of responsibility for safe vehicle operation.



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- 6.11 If the driver is alone, he/she should obtain backing assistance. If no assistance is available, the driver must dismount and check around the entire vehicle to ensure that the vehicle can be backed in a safe manner ("circle check").
- 6.12 Ambulances and medic units backing up at hospitals must use backup personnel when possible. If backup personnel are not available, the driver must use extreme caution when backing the unit, following the instructions outlined in 6.11.
- 6.13 All vehicles except automobiles, command units, and brush trucks must follow the back-up procedures outlined in 6.10-6.12 unless backup personnel are available.
- 6.14 Standardized hand signals must be used by back-up personnel. See Attachment 8.0.
- 6.15 No emergency vehicle shall pass another emergency vehicle responding to an incident, unless advised to do so by the lead unit.
- 6.16 Emergency vehicle drivers must not pass a stopped school bus that is discharging or pickup up passengers, or has its warning lights displayed, unless cleared to do so via eye contact and/or other visual signal with the driver of the school bus.
- 6.17 During emergency response and non-emergency travel, vehicles must come to a complete stop at all unguarded railroad grade crossings. Drivers must assure that it is safe to proceed before crossing tracks. This same caution must be exercised when approaching and crossing guarded railroad crossings.
- 6.18 Under emergency response driving conditions, drivers must allow sufficient distance between units based on road conditions, traffic, etc. When following an emergency vehicle, drivers must be aware that motorists may pull into their paths after yielding the right-of-way to a leading emergency vehicle.
- 6.19 During emergency response driving, drivers may exceed the posted speed limits, proceed against traffic control devices and the indicated direction of travel:



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- a. when exercising extreme caution and ensuring that the safety of all persons and property are not endangered; and
  - b. when the weather and visibility provide an adequate field of view, especially at intersections.
- 6.20 Drivers must be aware of the running routes of units responding to an incident and be alert for other units that responding.
- 6.21 Drivers must be aware of areas that require special consideration, such as dips, hills, high traffic flow, and intersections. Consideration should be given to alternate routes of travel.
- 6.22 Drivers must slow down well in advance of approaching the scene of an incident. This allows for size up and evaluation of the unit's positioning.
- 6.23 Personnel are not permitted to get on or off moving apparatus. Drivers and unit officers must ensure that all personnel are seated and/or properly restrained before the apparatus begins to move. Personnel may not ride any back step on fire apparatus except as outlined in FRC Executive Regulation 26-03, "Safety While on Apparatus."
- 6.24 Headlights must be used during emergency response driving and whenever windshield wipers are in operation.
- 6.25 When a vehicle is driven using chains, traction bars or similar devices, the maximum speed must not exceed 35 mph.
- a. When a vehicle is in motion with chains on, the cab windows are to be open at least 3".
  - b. Personnel who notice that chains have broken must notify the driver immediately. When a vehicle is on the air and not responding to an incident and a chain breaks, the driver must pull to the side of the road and temporarily repair or remove the chain. In addition, flashers, emergency warning lights and traffic cones or flares must be used.



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c. When a chain breaks while a vehicle is responding to an incident, the vehicle must be stopped and ECC notified that the apparatus has broken a chain. The crew will attempt to repair the break, continue to the incident, and notify ECC of their continued response.

6.26 Wheel chocks, when provided, must be used whenever the apparatus is parked anywhere other than inside the station. Ambulances, medic units, utility vehicles, brush trucks and cars may use parking brakes rather than wheel chocks. On slopes and hills, the wheels of a parked vehicle must be turned toward the curb.

6.27 During the daily apparatus check, drivers must ensure that all tools, appliances, equipment, hose, blind caps, compartment doors, passenger doors and cargo are secured to prevent accidents, injuries, or loss while the unit is in motion.

6.28 Operators should perform tests of visual and audible emergency warning devices in a manner that avoids confusing passing traffic. (e.g. Test emergency warning lights with apparatus bay doors down, test audible emergency warning devices without warning lights on and sound devices as briefly as possible).

## CANCELLATION

7.0 Policy #808, dated 12/04/91 is cancelled.

## ATTACHMENT

8.0 Standardized hand signals

a:sevo

STOP



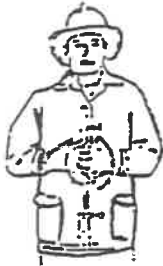
Hold hands to the side, shoulder high, exposing palms to driver. At night, hold hands in the same manner, with the addition of a flashlight in one hand, shining at the driver. This will indicate an immediate STOP.

RIGHT OR LEFT

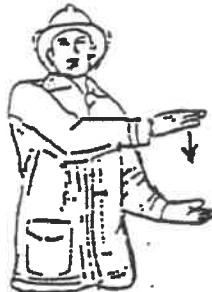
Point in the desired direction with one hand and motion in a circular "Come On" gesture with the other at chest level. At night, direct a flashlight beam at the hand pointing in the desired direction.



AHEAD OR BACK UP



Hold hands directly in front, chest high, fingers on hands directed toward one another, and motion in a circular "Come On" gesture. At night, hold a flashlight in one hand and direct the beam toward the other.



DIMINISHING CLEARANCE

Hold the hands to one side of the body indicating the approximate amount of distance the apparatus is from the obstacle. Close hands accordingly as the driver slowly maneuvers his apparatus toward same. Close hands as the distance narrows to a point where the signalman indicates immediate STOP. Always allow enough for driver's reaction time. At night, indicate in the same manner with a flashlight in the upper hand and beam directed at the palm of the other. On STOP, cover the flashlight beam with the hands.





DIVISION OF FIRE AND RESCUE SERVICES  
MONTGOMERY COUNTY, MD.

## DIRECTIVE

**NUMBER: 04-21**  
December 9, 2004

**TO:** All Montgomery County Fire and Rescue Service Personnel  
**FROM:** Gordon A. Aoyagi, Fire Administrator  
**SUBJECT:** MCFRS SAFE DRIVING ACTION PLAN

**Purpose:** To adopt uniform MCFRS procedures for emergency vehicle safe operations and apparatus driving.

The following system-wide Safe Driving Action Plan Directive is issued to reduce emergency vehicle collisions and incidents in the fire and rescue service. All MCFRS personnel must comply with the following:

1. Unit Officers who have arrived first on the scene of an incident and have made an assessment that the incident is to be safely mitigated and determined that the incident is not complex (minor vehicle collisions, single family home or other small structure with "nothing evident," etc. should have all other incoming units "proceed routine" to the scene of the incident. Unit Officers and Incident Commanders should also consider level one staging for units responding to the incident.
2. Unit Officers shall be responsible to provide immediate, affirmative direction to the driver of any vehicle to "slow down" if this directive is being violated or the speed of the vehicle is considered unsafe for driving conditions. Unit Officers shall also provide directions to discontinue any unsafe operations of an emergency vehicle. The Unit Officer should first attempt to correct the behavior through counseling, coaching, warning or an direct order to comply. If this intervention fails, the officer must order the emergency vehicle stopped in a safe location and remove the vehicle from response mode and to immediately discontinue any further unsafe action by the operator. This action must be taken by the officer even if it would delay or discontinue the response of the emergency vehicle to an emergency incident.
3. MCFRS driver operators shall not operate any MCFRS emergency vehicle (with emergency equipment activated) at a speed considered unsafe for the exiting roadway conditions and not greater than 15mph above the posted speed limit at any time. Vehicles operating in a routine response or driving routine must not exceed the posted speed limit.

4. All MCFRS driver operators operating in the emergency mode (emergency lights and sirens activated) must be in control of the vehicle and be able to come to a complete stop at all intersections to avoid a collision with another vehicle or pedestrian that may be in the intersection.
5. All MCFRS personnel must wear and use seat belts while riding on and/or driving any MCFRS vehicle. The Unit Officer must receive affirmative confirmation from each person on the unit that all personnel are seated, with seat belts fastened, prior to authorizing the vehicle driver to initiate any movement of the vehicle. On EMS units, patient care providers must also be belted at all times, unless wearing a seat belt would prohibit them from providing appropriate patient care.
6. EMS units (ALS and BLS) shall only utilize the emergency mode of transport for Priority 1 and Priority 2 patients with unresolved symptoms or pain or in cases where the patient condition may reasonably be expected to worsen.
7. All MCFRS collisions or incident involving any MCFRS emergency vehicle must be immediately reported, verbally and in writing by the collision/incident investigator, to the MCFRS Safety Office.
8. Drivers of medium duty vehicles (ambulances, brush trucks, vans, etc.) and heavy duty apparatus (engines, squads, aerial units, towers, tankers, etc.) and EMS vehicles must not use or operate handheld cell phones at any time while the driver is operating an emergency vehicle of this type.

## Emergency Vehicle Laws – 2017 Maryland Code

Section	Truncated Code
§ 11-118.  Emergency vehicle definition	<p>"Emergency vehicle" means any of the following vehicles that are designated by the Administration as entitled to the exemptions and privileges set forth in the Maryland Vehicle Law for emergency vehicles:</p> <p>(2) Vehicles of volunteer fire companies, rescue squads, fire departments, the Maryland Institute for Emergency Medical Services Systems, and the Maryland Fire and Rescue Institute;</p> <p>(5) Ambulances; and</p> <p>(6) Special vehicles funded or provided by federal, State, or local government and used for emergency or rescue purposes in this State.</p>
§ 11-162.  Stop definition	<p>"Stop" means:</p> <p>(1) Where used in a mandatory sense, the complete cessation from movement; and</p> <p>(2) Where used in a prohibitory sense, to halt even momentarily a vehicle, whether or not it is occupied, except when necessary to avoid conflict with other traffic or in compliance with the directions of a police officer or a traffic control device.</p>
§ 16-102.  Persons exempt from commercial vehicle licensing requirements.	<p>(a) In general. -- The licensing requirements of this title do not apply to:</p> <p>(12) A member or employee of a fire department, rescue squad, emergency medical services unit, or volunteer fire company while driving an emergency vehicle if the driver:</p> <ul style="list-style-type: none"> <li>(i) Holds a valid Class C license issued to the driver under § 16-104.1 of this subtitle;</li> <li>(ii) Has been authorized by the political subdivision that operates a fire department, rescue squad, emergency medical services unit, or volunteer fire department to operate the type of emergency vehicle being driven; and</li> <li>(iii) Is driving the emergency vehicle in the performance of the official duties of the driver in or out of this State.</li> </ul> <p>(b) Regulations. --</p> <p>(1) The Administration shall adopt regulations that establish mandatory training and testing requirements that a political subdivision that operates a fire department, rescue squad, emergency medical services unit, or volunteer fire department must implement before the political subdivision may authorize an individual to operate an emergency vehicle in accordance with subsection (a)(12) of this section.</p> <p>(2) The Administration shall adopt the regulations required under this subsection in consultation with:</p> <ul style="list-style-type: none"> <li>(i) The Maryland Firemen's Association;</li> <li>(ii) The Maryland Fire Chief's Association;</li> <li>(iii) The Professional Firefighters Association of Maryland;</li> <li>(iv) The Metropolitan Fire Chief's Council; and</li> <li>(v) The Maryland Fire and Rescue Institute of the University of Maryland.</li> </ul>

## Emergency Vehicle Laws – 2017 Maryland Code

Section	Truncated Code
<p>§ 19-103.</p> <p>Liability for negligent operation of emergency vehicle</p>	<p>(2) "Emergency service" means:</p> <p style="padding-left: 20px;">(i) Responding to an emergency call;</p> <p style="padding-left: 20px;">(iii) Responding to, but not while returning from, a fire alarm.</p> <p>(3) "Emergency vehicle" has the same meaning as in § 11-118 of this article.</p> <p>(b) Liability of operator. -- An operator of an emergency vehicle, who is authorized to operate the emergency vehicle by its owner or lessee while operating the emergency vehicle in the performance of emergency service as defined in subsection (a) of this section shall have the immunity from liability described under § 5-639(b) of the Courts and Judicial Proceedings Article.</p> <p>(c) Liability of owner or lessee. --</p> <p>(1) An owner or lessee of an emergency vehicle, including a political subdivision, is liable to the extent provided in § 5-639(c) of the Courts and Judicial Proceedings Article for any damages caused by a negligent act or omission of an authorized operator while operating the emergency vehicle in the performance of emergency service as defined in subsection (a) of this section.</p> <p>(2) An owner or lessee of an emergency vehicle, including a political subdivision, shall have the immunity from liability described under § 5-639(c) of the Courts and Judicial Proceedings Article.</p> <p>(d) Liability for self-insured jurisdiction. -- A self-insured jurisdiction shall have the immunity from liability under this section as described under § 5-639(d) of the Courts and Judicial Proceedings Article.</p>
<p>§ 5-639.</p> <p>Negligent operation of emergency vehicle</p>	<p>(b) Liability of operator. --</p> <p>(1) An operator of an emergency vehicle, who is authorized to operate the emergency vehicle by its owner or lessee, is immune from suit in the operator's individual capacity for damages resulting from a negligent act or omission while operating the emergency vehicle in the performance of emergency service.</p> <p>(2) This subsection does not provide immunity from suit to an operator for a malicious act or omission or for gross negligence of the operator.</p> <p>(c) Liability of owner or lessee. --</p> <p>(1) An owner or lessee of an emergency vehicle, including a political subdivision, is liable to the extent provided in subsection (d) of this section for any damages caused by a negligent act or omission of an authorized operator while operating the emergency vehicle in the performance of emergency service.</p> <p>(2) This subsection does not subject an owner or lessee to liability for the operator's malicious act or omission or for the operator's gross negligence.</p>

## Emergency Vehicle Laws – 2017 Maryland Code

Section	Truncated Code
	<p>(3) A political subdivision may not raise the defense of governmental immunity in an action against it under this section.</p> <p>(d) Limitation on liability. -- Liability under this section for self-insured jurisdictions is limited to the amount of the minimum benefits that a vehicle liability insurance policy must provide under § 17-103 of the Transportation Article, except that an owner or lessee may be liable in an amount up to the maximum limit of any basic vehicle liability insurance policy it has in effect exclusive of excess liability coverage.</p> <p>(e) Effect of judgment. -- A judgment under this section against the owner or lessee of an emergency vehicle constitutes a complete bar to any action or judgment deriving from the same occurrence against the operator of the emergency vehicle.</p>
<p>§ 21-106. Emergency vehicle Privileges</p>	<p>(a) Circumstances for which privileges granted. -- Subject to the conditions stated in this section:</p> <p>(1) The driver of an emergency vehicle registered in any state may exercise the privileges set forth in this section while:</p> <p>(i) Responding to an emergency call;</p> <p>(iii) Responding to, but not while returning from, a fire alarm; and</p> <p>(b) Enumeration of privileges. -- Under the circumstances stated in subsection (a) of this section, the driver of an emergency vehicle may:</p> <p><b>(1) Park or stand without regard to the other provisions of this title;</b></p> <p><b>(2) Pass a red or stop signal, a stop sign, or a yield sign, but only after slowing down as necessary for safety;</b></p> <p><b>(3) Exceed any maximum speed limit, but only so long as the driver does not endanger life or property;</b></p> <p><b>(4) Disregard any traffic control device or regulation governing direction of movement or turning in a specified direction;</b></p> <p>(c) Use of audible and visual signs required. --</p> <p>(1) Subject to paragraph (2) of this subsection, the privileges set forth in this section apply <b>only while the emergency vehicle is using audible and visual signals</b> that meet the requirements of § 22-218 of this article, except that an emergency vehicle operated as a police vehicle need not be equipped with or display the visual signals.</p> <p>(2) The privileges set forth in subsection (b) (1) of this section apply only while the emergency vehicle is using visual signals that meet the requirements of § 22-218 of this article.</p> <p>(i) The driver of an emergency vehicle may not use flashing lights or a bell, siren, or exhaust whistle while returning from an emergency call, fire alarm, or motorcade or escort, except that fire apparatus carrying standing firemen may use flashing lights that are visible only to the rear.</p>

## Emergency Vehicle Laws – 2017 Maryland Code

Section	Truncated Code
	<p>(ii) The driver of an emergency vehicle, while parking or backing the emergency vehicle, may use flashing lights within 100 feet of the entrance ramp to a:</p> <ol style="list-style-type: none"> <li>1. Fire station; or</li> <li>2. Rescue station.</li> </ol> <p>(4) Before exercising the privileges set forth in subsection (b)(5) of this section, the jurisdiction that employs the driver of a motorcade or escort shall provide notice of the motorcade or escort to any jurisdiction that the driver will enter while performing or returning from the motorcade or escort duty.</p> <p><b>(d) Driver not relieved from duty of care. -- This section does not relieve the driver of an emergency vehicle from the duty to drive with due regard for the safety of all persons.</b></p>
<p>§ 21-405. Operation of vehicles on approach of emergency vehicles or tow trucks. “right of way” “move over law”</p>	<p>(a) In general. -- On the immediate approach of an emergency vehicle using audible and visual signals that meet the requirements of § 22-218 of this article or of a police vehicle lawfully using an audible signal, the driver of every other vehicle, unless otherwise directed by a police officer, shall yield the right-of-way.</p> <p>(b) Duty of driver upon approach of emergency vehicle. -- On the immediate approach of an emergency vehicle using audible and visual signals that meet the requirements of § 22-218 of this article, the driver of every other vehicle, unless otherwise directed by a police officer, shall drive immediately to a position parallel to and as close as possible to the edge or curb of the roadway, clear of any intersection.</p> <p>(c) Stopping until emergency vehicle passes. -- On the immediate approach of an emergency vehicle using audible and visual signals that meet the requirements of § 22-218 of this article or of a police vehicle lawfully using an audible signal, the driver of every other vehicle, unless otherwise directed by a police officer, shall stop and stay in this position until the emergency vehicle has passed.</p> <p>(d) Passing emergency or police vehicle. -- A driver, when proceeding in the same direction as an emergency or police vehicle, may not pass an emergency vehicle using audible and visual signals that meet the requirements of § 22-218 of this article or a police vehicle lawfully using an audible signal unless:</p> <ol style="list-style-type: none"> <li>(1) The emergency vehicle has stopped; or</li> <li>(2) Otherwise directed by a police officer.</li> </ol> <p>(e) Duty of driver upon approach of emergency vehicle or tow trucks on highway. -- Unless otherwise directed by a police officer or a traffic control device, when an emergency vehicle or a tow truck that is properly registered in accordance with § 13-920 of this article using any visual signal that meets the requirements of § 22-218 of this article is stopped, standing, or parked on a highway, the driver of a motor vehicle approaching the emergency vehicle or tow truck from the rear shall:</p> <ol style="list-style-type: none"> <li>(1) If practicable and not otherwise prohibited, make a lane change into an available lane not immediately adjacent to the emergency vehicle or tow truck with due regard for safety and traffic conditions; or</li> </ol>

## Emergency Vehicle Laws – 2017 Maryland Code

Section	Truncated Code
	<p>(2) If the driver of the motor vehicle is unable to make a lane change in accordance with item (1) of this subsection, slow to a reasonable and prudent speed that is safe for existing weather, road, and vehicular or pedestrian traffic conditions.</p> <p>(f) Driver of emergency vehicle not relieved from duty of care. -- This section does not relieve the driver of an emergency vehicle from the duty to drive with due regard for the safety of all persons.</p>
§ 21-510. Pedestrians to yield right-of-way to emergency vehicles	<p>(a) In general. -- A pedestrian who crosses a roadway shall yield the right-of-way to any approaching emergency vehicle that is using audible and visual signals that meet the requirements of § 22-218 of this article.</p> <p>(c) Driver not relieved from duty of care. -- This section does not relieve the driver of an emergency vehicle from the duty to drive with due regard for the safety of all persons.</p>
§ 21-706. Overtaking and passing school vehicle	<p>(a) Driver to stop on meeting or overtaking stopped school vehicle -- In general. -- If a school vehicle has stopped on a roadway and is operating the alternately flashing red lights specified in § 22-228 of this article, the driver of any other vehicle meeting or overtaking the school vehicle shall stop at least 20 feet from the rear of the school vehicle, if approaching the school vehicle from its rear, or at least 20 feet from the front of the school vehicle, if approaching the school vehicle from its front.</p> <p>(b) Driver to stop on meeting or overtaking stopped school vehicle -- When vehicles may proceed. -- If a school vehicle has stopped on a roadway and is operating the alternately flashing red lights specified in § 22-228 of this article, the driver of any other vehicle meeting or overtaking the school vehicle may not proceed until the school vehicle resumes motion or the alternately flashing red lights are deactivated.</p> <p>(c) Exceptions. -- This section does not apply to the driver of a vehicle on a divided highway, if the school vehicle is on a different roadway.</p>
§ 21-801. Basic rules - speeds	<p>(a) Reasonable and prudent speed required. -- A person may not drive a vehicle on a highway at a speed that, with regard to the actual and potential dangers existing, is more than that which is reasonable and prudent under the conditions.</p> <p>(b) Driver to control speed. -- At all times, the driver of a vehicle on a highway shall control the speed of the vehicle as necessary to avoid colliding with any person or any vehicle or other conveyance that, in compliance with legal requirements and the duty of all persons to use due care, is on or entering the highway.</p> <p>(c) Drivers to reduce speed in certain circumstances. -- Consistent with the requirements of this section, the driver of a vehicle shall drive at an appropriate, reduced speed when approaching and crossing an intersection at which cross traffic is not required to stop by a traffic control device.</p> <p>(d) Approaching and crossing railroad grade crossings. -- Consistent with the requirements of this section, the driver of a vehicle shall drive at an appropriate, reduced speed when approaching and crossing a railroad grade crossing.</p>

## Emergency Vehicle Laws – 2017 Maryland Code


Section	Truncated Code
	<p>(e) Approaching and going around curves. -- Consistent with the requirements of this section, the driver of a vehicle shall drive at an appropriate, reduced speed when approaching and going around a curve.</p> <p>(f) Approaching crests of grades. -- Consistent with the requirements of this section, the driver of a vehicle shall drive at an appropriate, reduced speed when approaching the crest of a grade.</p> <p>(g) Traveling on narrow or winding roadways. -- Consistent with the requirements of this section, the driver of a vehicle shall drive at an appropriate, reduced speed when traveling on any narrow or winding roadway.</p> <p>(h) Special dangers as to pedestrians or other traffic. -- Consistent with the requirements of this section, the driver of a vehicle shall drive at an appropriate, reduced speed when any special danger exists as to pedestrians or other traffic or because of weather or highway conditions.</p>
§ 21-1109. Following fire apparatus prohibited; passing parking or backing emergency vehicles prohibited	<p>(a) Fire apparatus. -- Unless he is on official business, the driver of a vehicle may not:</p> <p>(1) Follow within 500 feet of any fire apparatus traveling in response to a fire alarm; or</p> <p>(2) Drive or park within 300 feet of any fire apparatus stopped in response to a fire alarm.</p> <p>(b) Passing parking or backing emergency vehicles. -- The driver of a vehicle may not pass an emergency vehicle within 100 feet of an entrance ramp of a fire or rescue station when the emergency vehicle is in the process of parking or backing.</p>
§ 21-1110. Crossing fire hose	<p>Unless he has the consent of the fire department official in command, the driver of a vehicle may not drive over any unprotected hose of a fire department that is laid down on any highway or private driveway.</p>
§ 21-1120. Wearing earphones, headsets, etc., prohibited	<p>(a) Earplugs. -- A person may not drive a motor vehicle on any highway or on any private property that is used by the public in general in this State while the person is wearing over or in both ears earplugs.</p> <p>(b) Headsets. -- A person may not drive a motor vehicle on any highway or on any private property that is used by the public in general in this State while the person is wearing over or in both ears a headset.</p> <p>(c) Earphones. -- A person may not drive a motor vehicle on any highway or on any private property that is used by the public in general in this State while the person is wearing over or in both ears earphones attached to a radio, tape player, or other audio device.</p> <p>(e) Exception for emergency vehicles under emergency conditions. --</p> <p>(1) The provisions of subsections (a) and (c) of this section do not apply to a person operating an authorized emergency vehicle under emergency conditions.</p> <p>(2) The provisions of subsection (b) of this section do not apply to a person operating an authorized emergency vehicle:</p> <p>(i) Under emergency conditions; or</p> <p>(ii) Who is wearing a headset for the purpose of communicating with other emergency personnel.</p>

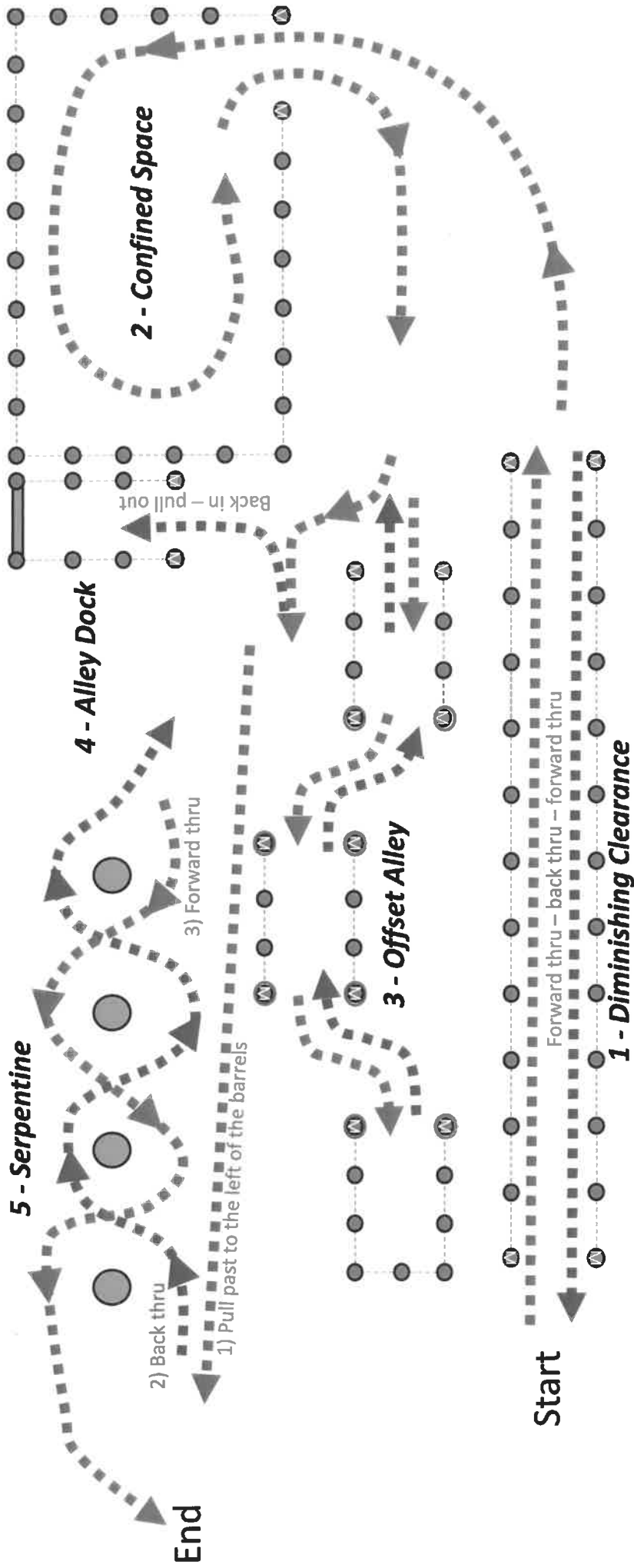
## Emergency Vehicle Laws – 2017 Maryland Code

Section	Truncated Code
§ 22-218. Audible and visual signals on vehicles	<p>(a) Sirens, exhaust whistles, or bells on emergency vehicles. -- Every emergency vehicle, in addition to any other equipment and distinctive markings required by this subtitle, shall be equipped with a siren, exhaust whistle, or bell capable of giving an audible signal.</p> <p>(b) Flashing red lights on emergency vehicles; warning lights on school vehicles. --</p> <p>(1) Every emergency vehicle, in addition to any other equipment and distinctive markings required by the Maryland Vehicle Law, shall be equipped with signal lamps mounted as high as practicable, which shall be capable of displaying to the front and to the rear a flashing red light or lights. These lights shall have sufficient intensity to be visible at 500 feet in normal sunlight.</p> <p>(c) Oscillating, blinking, etc., lights on certain vehicles. --</p> <p>(1) A person may not drive or move on any highway any vehicle or equipment that is equipped with or displays any light or signal device designed to emit an oscillating, rotating, blinking, or other type of emission of light, unless designated and authorized by the Administrator as indicated in paragraphs (2) through (12) of this subsection. The provisions of this section do not prohibit the display and use of any lighting device that may be permitted or required elsewhere in the Maryland Vehicle Law.</p> <p>(2) Vehicles of the police department and other city, county, State, or federal law enforcement agencies may be equipped with and display red, white, or blue lights or signal devices.</p> <p>(3)</p> <p>(i) Vehicles of city, county, State, or federal fire departments or duly constituted volunteer fire departments or rescue squads, or the Maryland Institute for Emergency Medical Services System, may be equipped with or display red and/or white lights or signal devices.</p> <p>(ii) In each volunteer fire company, no more than five of the following officers may have their privately owned vehicles equipped with red lights or signal devices which may be displayed only while on route to or at the scene of an emergency:</p> <ol style="list-style-type: none"> <li>1. The fire chief or the highest ranking fireline officer;</li> <li>2. One or more of the assistant chiefs or deputy chiefs, whichever rank is second in command; and</li> <li>3. The emergency medical services commander.</li> </ol> <p>(iii)</p> <ol style="list-style-type: none"> <li>1. The fire police of each volunteer fire company may have their privately owned vehicles equipped with red lights or signal devices designed to emit an oscillating, rotating, blinking, or other type of emission of light.</li> <li>2. The lights or signal devices may be flashed or oscillated or otherwise used only while the vehicle is at the scene of an accident, flood, or other emergency to which the volunteer fire company is responding.</li> </ol> <p>(4) Ambulances may be equipped with or display red and/or white lights or signal devices.</p>

## Emergency Vehicle Laws – 2017 Maryland Code

Section	Truncated Code
	<p>(9)</p> <p>(i) Except as provided in subparagraphs (ii) and (iii) of this paragraph, the blue, red, or white lights or signal devices may be flashed or oscillated or otherwise used only while on route to or at the scene of an emergency, and their use does not relieve an emergency vehicle from otherwise giving an audible warning as required elsewhere in the Maryland Vehicle Law.</p> <p>(ii) The driver of an emergency vehicle may use flashing lights within 100 feet of the entrance ramp of a fire or rescue station while parking or backing the emergency vehicle.</p> <p>(iii) The driver of an emergency vehicle of a fire department or rescue squad shall, at the discretion of the officer in charge, flash or oscillate or otherwise use red and white lights or signal devices while stopped, standing, or parked on the roadway at the scene of an emergency.</p> <p>(10) A stationary emergency vehicle serving as a mobile command unit may be equipped with or display a flashing, blinking, or oscillating green light or signal device to designate the vehicle as the command post.</p> <p>(f) Drivers to yield right-of-way and stop. -- The use of the signal equipment described in this section imposes on drivers of other vehicles the obligation to yield the right-of-way and stop as required in Title 21 of this article.</p>
§ 22-401. Horns and warning devices	<p>(e) Sirens, whistles, or bells on emergency vehicles. -- Every emergency vehicle shall be equipped with a siren, whistle, or bell capable of emitting sound audible under normal conditions from a distance of not less than 500 feet. However, the siren may not be used except when the vehicle is operated in response to an emergency call or in the immediate pursuit of an actual or suspected violator of the law, in which latter events the driver of the vehicle shall sound the siren when reasonably necessary to warn pedestrians and other drivers of the approach of the vehicle.</p>
§ 22-412.4. Seat belts or restraining devices in emergency vehicles	<p>(a) Definitions. --</p> <p>(1) In this section the following words have the meanings indicated.</p> <p>(2) "Seat belt" means a restraining device described under § 22-412 of this subtitle.</p> <p>(3) "Vehicle" means an emergency vehicle purchased or leased by the State, a county, municipality, or volunteer fire department or rescue squad and operated by a:</p> <p>(i) State, county, or municipal fire department;</p> <p>(ii) Volunteer fire department; or</p> <p>(iii) Rescue squad.</p> <p>(b) Required. -- A vehicle registered in the State and manufactured and assembled after January 1, 1990 shall be equipped with a seat belt or safety restraining device approved by the local authority having jurisdiction for each position on the vehicle that may be lawfully occupied by a passenger.</p>

**All-ster axle units** – with all-ster locked out, adjust offset alley cones so the lanes are 18" shorter on each end. The cones that are adjusted are designated by .





### EMERGENCY VEHICLE OPERATOR CLASS "B"

Module 2  
Major Vehicle Systems  
Pre-trip Inspections



### OBJECTIVES

- Identify the major vehicle systems and their component parts
- Determine methods and requirements for pre-trip inspection of vehicle systems
- Define maintenance requirements for vehicle systems
- Review MCFRS out-of-service criteria for fire department apparatus
- Review defect reporting and resources for apparatus operators



### MOTIVATION WHY KNOW THE COMPONENTS?

- Correctly identify defects and write accurate defect reports
- Determine and differentiate between normal, monitoring, and out of service conditions
- Identify critical safety issues before they cause injury or damage
- Ability to communicate with mechanics when describing conditions – "speaking their language"
- Make educated decisions about the vehicle you are driving!



### DEFINITIONS

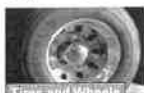
- Leakage
  - Class 1: seepage of fluid; not enough to form drops
  - Class 2: leakage great enough to form drops; drops do not drip
  - Class 3: leakage great enough for drops to drip
- Operational Test: A test to determine the operational readiness of a component on a fire apparatus by observing the actual operation of the component.



### FIVE MAJOR SYSTEMS

There are five primary vehicle systems that impact your ability to safely control the apparatus:

1. Tires
2. Wheels
3. Steering
4. Suspension
5. Brakes



### TIRES


- Key to all vehicle movement
  - Steering
  - Braking
  - Accelerating
- CID
  - Condition
  - Inflation
  - Depth



### TIRES C: CONDITION

- No cuts that expose cord
- No bulges on sidewall which indicates cord separation
- Front tires are not re-grooved or recapped
- Front tires are not mismatched

**\*CID\***

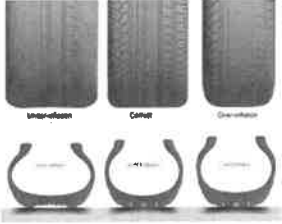


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### TIRES I: INFLATION

Improper inflation....

- ✓ Increases stress on the tire
- ✓ Reduces performance in emergency handling
- ✓ Increases wear
- ✓ Increases resistance to rolling and creates heat




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### TIRES I: INFLATION

- Any tires obviously flat?
- Listen and look for leaks
- Look for abnormal bulging
  - Dual wheels should not be touching each other
  - 4 lugs touching the ground
- Measure the tire pressure
  - Verify against pressures provided by the manufacturer
  - On the data plate in the cab or on a door frame
- Ensure valve stems are capped and not touching the wheel
- Automated pressure monitoring systems are not in use in MCFR

**\*CID\***




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### TIRES D: DEPTH

Insufficient tread depth....

- Increases stopping distance
- Reduces steering performance
- Fails to channel rain and snow from beneath the tread hydroplaning




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### TIRES D: DEPTH

- DOT minimum tread depths
  - Steering axles: 4/32 inch
  - Other axles: 2/32 inch
- No pieces of tread missing exposing cords
- Tread should be worn evenly
- Tread depth will be obtained from any major groove
  - Check multiple areas around the tire
  - Check in different grooves
  - Check the deepest portion of the groove and not on top of a tie bar or hump

**\*CID\***




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### TIRES D: DEPTH


**Steering Axles—4/32"**

When a Quarter is inserted into the grooves of the tread the top of George Washington's head should be below the tread surface. The tread depicted in the photo has just enough tread depth.



**Non-Steering Axles—2/32"**

When a Penny is inserted into the grooves of the tread the top of Abraham Lincoln's head should be below the tread surface. The tread depicted in the photo has just enough tread depth.




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### TIRES

#### OTHER CONSIDERATIONS

- Steering tires
  - Do the tread patterns match from side to side?
  - Are they the same size and type?
- Non-steering tires - duals
  - Each pair of tires is designed to carry a load together
  - Damage, incorrect inflation, or uneven wear transfers more load to one tire
  - Best practice is to mount only the same brand of tire with the same tread pattern and depth (within 4/32) in a dual assembly

DOT does not mandate tire specifications



### TIRES

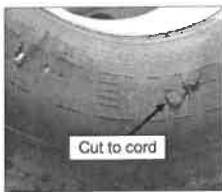
#### OTHER CONSIDERATIONS

- Does the tire capacity match the axle weight ?
- Does the tire's maximum air pressure match the wheels maximum air pressure ?
- Does the wheels maximum weight match the axle weight ?
- Are they certificate tire's
- Are they certificate wheels

### TIRES

#### OOS CRITERIA


- Steering tires with  $<4/32"$  of tread
- Rear tires with  $<2/32"$  of tread
- Tire pressure that exceeds maximum air pressure of the wheel
- Dual tires that are contacting each other even when at maximum pressure (overload)
- Tire that is cut to the cord
- Tire that is flat or has a detectable or audible leak
- Any tire with a noticeable bulge on the sidewall



### WHEELS


#### ALUMINUM

- Single piece aluminum
- Inspect for:
  - Cracks
  - Corrosion
  - Wear
  - Rust streaks
  - Other damage
- Lugs must be hand tight
- Heat damage



### WHEELS


#### ALUMINUM - PRE-2009



A blistered, blackened or cracked looking logo decal on an Alcoa wheel may indicate that the wheel has been exposed to excessive heat

### WHEELS


#### ALUMINUM - POST-2009



- Starting in January 2009, 1-inch round clear heat indicator near the stamp on the wheel
- Blistering, charred, blackened, or cracked appears indicates excessive heat

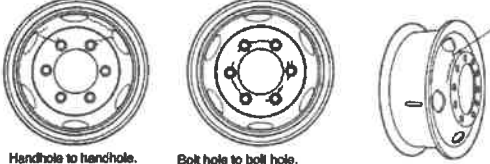
### WHEELS STEEL

- Single piece steel
- Inspect for:
  - Cracks
  - Corrosion
  - Wear
  - Other damage
- Lugs must be hand tight



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### WHEELS STEEL



Cracks at disc nave and/or handhole. Causes: Bad fit-up, damaged hub, overload or sharp edge at handhole.


Handhole to handhole. Handhole to bolt hole. Handhole to rim. Cause: Overloading.

Bolt hole to bolt hole. Causes: Loose cap nuts, small hub backup (also see bolt hole cracks/distortions).

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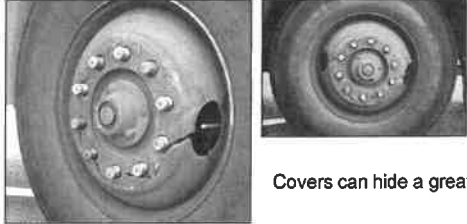
### WHEELS AESTHETIC COVERS

- Economical alternative to aluminum wheels
- Covers installed over steel wheels or old aluminum wheels
  - Hook onto hand holds
- Covers bear NONE of the load
- Hide corrosion, damage, leaking hubs, or defects in the load-bearing component of the wheel
- Obscures hub oil window



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### WHEELS AESTHETIC COVERS

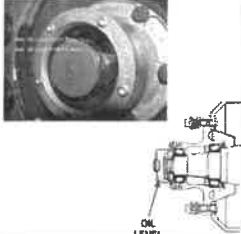


Covers can hide a great deal of damage!

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### WHEELS FRONT AXLE HUB OIL

- Check hub seals for leaks
  - Look for oil spray on the hub and rims
- Before pulling the center plug, view the oil level through the sight glass
- With the plug removed, oil level should be well below the lip of the center plug
- Do not remove center plugs with screwdrivers or tools
  - Damage to the rubber seal or housing will result




OIL LEVEL

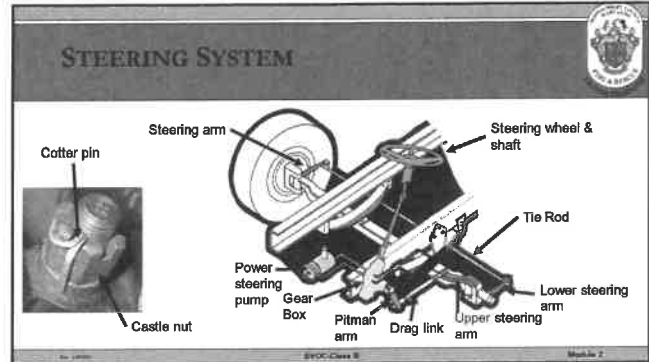
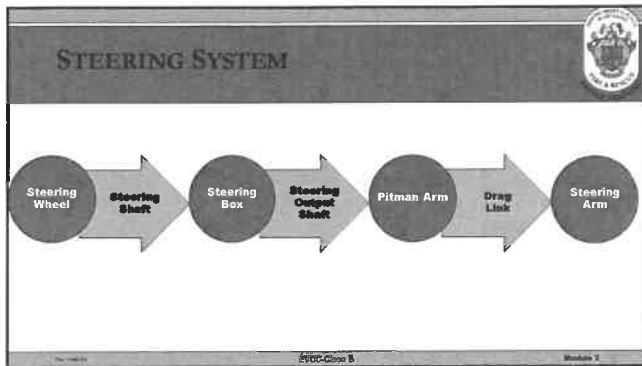
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### WHEELS OOS CRITERIA

- Wheel studs missing
- Loose wheel lugs
- Cracked, bent, or broken
- Hub seal with a Class 3 leakage or an empty reservoir



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### STEERING SYSTEM POWER STEERING

- Fluid Reservoir
  - o No leaks
  - o No damage
  - o Securely capped
  - o Adequate fluid level
- Power Steering Pump
  - o No leaks
  - o No damage
  - o Securely mounted

EVOC-Class B    Module 2

### STEERING SYSTEM STEERING SHAFT

- No bends
- No welds or repairs
- Universal joint(s) intact with no excessive play

Steering shaft    Universal joint

EVOC-Class B    Module 2

### STEERING SYSTEM GEAR BOX & PITMAN ARM

- Gear Box
  - o Securely mounted
  - o Hoses in good condition
  - o Hydraulic leaks
- Pitman Arm
  - o Secure to the output shaft of the gear box
    - Markings on the pitman arm align with marking on the output shaft
  - o Castle nut for drag link intact with cotter pin
  - o No side to side play

Hydraulic input & output    Drag Link    Pitman Arm    Gear Box

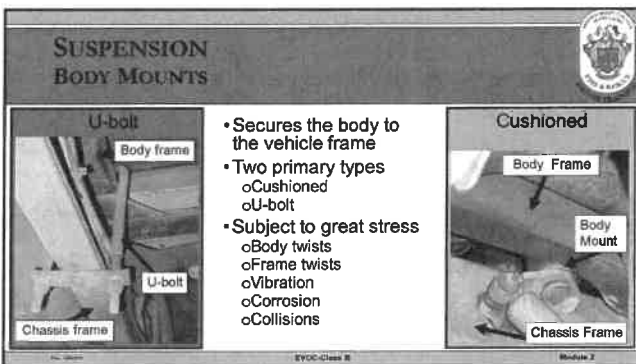
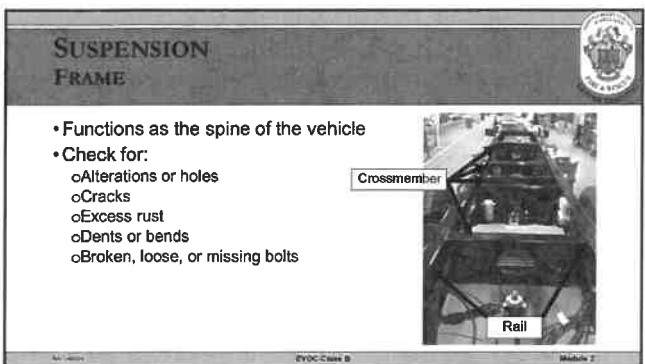
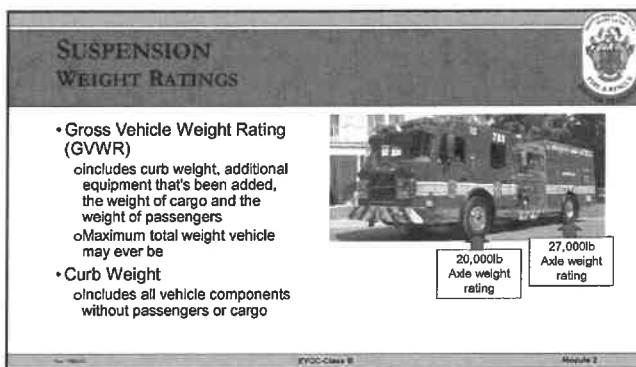
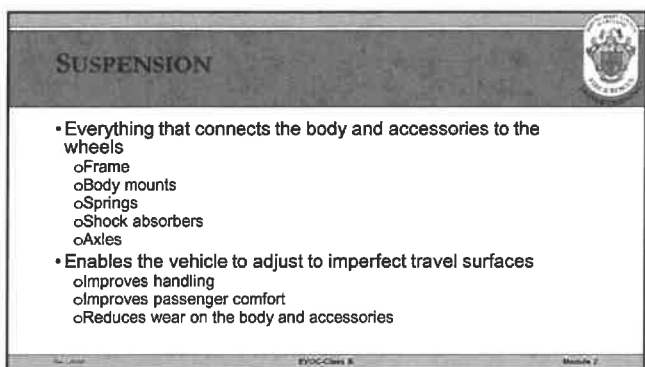
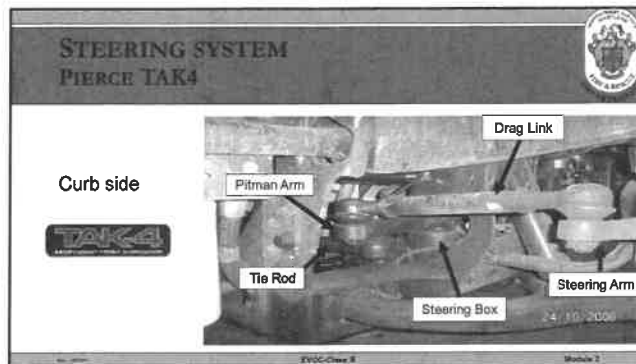
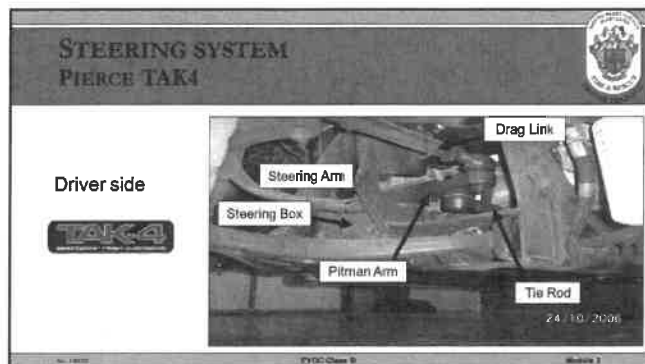
EVOC-Class B    Module 2

### STEERING SYSTEM DRAG LINK, STEERING ARMS, TIE ROD

- Drag Link
  - o <1/8" play horizontally
  - o <1/8" play vertically
  - o No bends or damage
  - o Secure to Pitman Arm and Steering Arm with castle nut & cotter pin
- Steering Arm
  - o No damage
  - o No play
- Tie Rod
  - o No damage
  - o No play
  - o Secured to Steering Arm with castle nut & cotter pin

Pitman Arm    Drag Link    Upper Steering Arm    Tie Rod    Lower Steering Arm

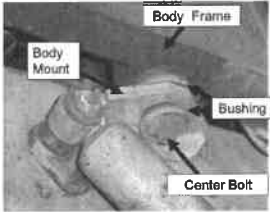
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## SUSPENSION CUSHIONED BODY MOUNTS

**OOS Defects**

- Any rubber bushings that are missing
- Any center bolt that is missing or will not tighten
- Mounts that have broken welds or not attached to the frame

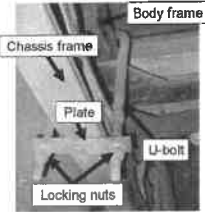


Labels in diagram: Body Frame, Body Mount, Bushing, Center Bolt

## SUSPENSION U-BOLT BODY MOUNTS

**OOS Defects**

- Broken components
- Missing locking nuts
- Loose U-bolt that allows sliding on the frame
- Cracked or broken plate securing the U-bolt.

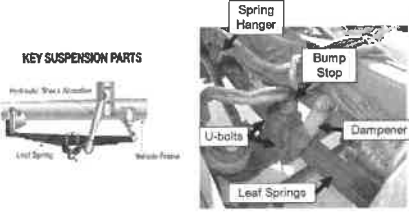


Labels in diagram: Body frame, Chassis frame, Plate, U-bolt, Locking nuts

## SUSPENSION SPRINGS

**KEY SUSPENSION PARTS**

- Provides the necessary flex and shock absorption to adjust to road surfaces
- Constantly under stress and load




Labels in diagram: Spring Hanger, Bump Stop, U-bolts, Dampener, Leaf Springs, Leaf Spring, Vehicle Frame

## SUSPENSION SPRINGS

**OOS Criteria**

- Missing or misaligned leaf springs
- Cracked or broken leaf spring
  - Top or bottom of the stack requires a tow
- Missing or loose bolts at spring shackle or spring mount
- Broken spring hanger
- Broken or dislodged dampener

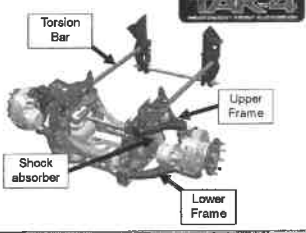


Labels in diagram: Spring Hanger, Bump Stop, U-bolts, Dampener, Leaf Springs, Leaf Spring, Vehicle Frame

## SUSPENSION PIERCE TAK4 – STEERING AXLE

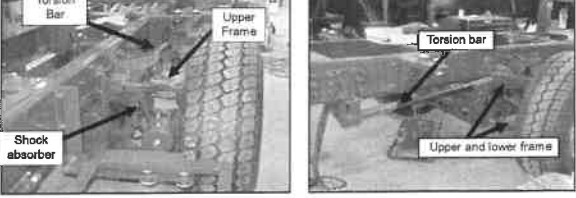
**OOS Defects**

- Steering axle on Pierce units
  - Front axle
  - Tiller axle
  - NOT on All-Steers
- Uses a torsion bar system – no springs
  - upper and lower A-frame assembly
  - shock absorber for wheel control.



Labels in diagram: Torsion Bar, Upper Frame, Lower Frame, Shock absorber


## SUSPENSION PIERCE TAK4



Labels in diagram: Torsion Bar, Upper Frame, Shock absorber, Upper and lower frame

### SUSPENSION PIERCE TAK4 – STEERING AXLE



- Model years 2004-2013
  - Ball joint failure
- Model years 2009-2013
  - Lower control arm failure
- Check these components thoroughly during pre-trip



EVOC Class B Module 2

### FRONT SUSPENSION PIERCE ENFORCER ENGINES

- When placed under the stress of emergency braking, front springs flatten and then assume a shape resembling an "S" as the front axle tries to rotate
- To reduce undesirable steering reaction during emergency braking, the front suspension includes "S-buffers" that stiffen the springs when the springs are compressed.

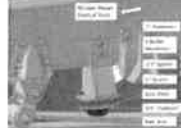



EVOC Class B Module 2

### FRONT SUSPENSION PIERCE ENFORCER ENGINES

**Daily**

- Inspect for loose hardware of the S-Buffer Assembly.
- Inspect welds and surrounding metal of the S-Buffer Assembly for cracks.
- Look for signs of failure or tearing of the Rubber Axle Stop.



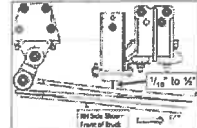
If cracks are found in the metal of the S-Buffer, or if loose hardware is found, submit a defect report.  
 If the Rubber Axle Stop has surface cracks, submit a defect report.  
 If the Rubber Axle Stop is missing, failed, or torn, the truck should be placed out of service and the Rubber Axle Stop replaced. Physical inspection of spring for mechanical damage should take place.

EVOC Class B Module 2

### FRONT SUSPENSION PIERCE ENFORCER ENGINES

**Monthly**

- Complete the daily inspection and;
- Park loaded vehicle (with water, foam, equipment) on flat level ground with wheels pointed straight. Ensure parking brake is applied and wheels are chocked.
- Inspect gap between Rubber Axle Stop and spring. Acceptable range is 1/16" to 1/2".

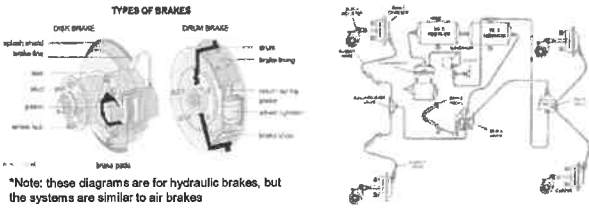


If the gap is outside of accepted range drive cautiously around parking lot, re-position on flat level ground with wheels straight and re-measure the gap.  
 > 1/2": place the vehicle out of service and contact CMF.  
 < 1/16" or the Rubber Axle Stop is touching: submit a defect report. NOTE: This is not an immediate out of service condition.

EVOC Class B Module 2

### AIR BRAKES COMPONENTS

**TYPES OF BRAKES**




\*Note: these diagrams are for hydraulic brakes, but the systems are similar to air brakes

**Air Brake System Video**


EVOC Class B Module 2

### AIR BRAKES COMPONENTS



**Gear-driven air compressor**

- Braided hoses are indicative of higher pressures and heat resistance




**Air Dryer**

- Reduces contaminants in the storage tanks and system valves

EVOC Class B Module 2


## AIR BRAKES COMPONENTS

- Air Storage Tanks**
  - **Wet or Supply Tank**
    - o First tank after the compressor
    - o Generally where heated compressor air cools and water condenses
  - **Primary, Secondary Tanks**
    - o Usually two or three
    - o Volume depends on the size of the brake system




EVOC-Class B Module 2


## AIR BRAKES AIR STORAGE - BLEEDERS



Manifold system



Petcock



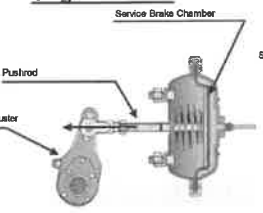
Lanyard

Draining the tanks is a weekly task

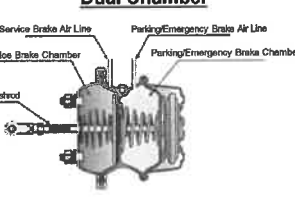
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## AIR BRAKE SYSTEM COMPONENTS

### Single Chamber




### Dual Chamber




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## AIR BRAKE SYSTEM CRIMSON COMPONENTS



- **Front Axle**
  - o No parking brake
  - o Single chamber air can
  - o Disc brakes



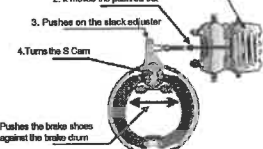
- **Rear Axle**
  - o Dual chamber air can
  - o Parking brake
  - o Drum brakes

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## AIR BRAKES PARKING - SPRING BRAKE

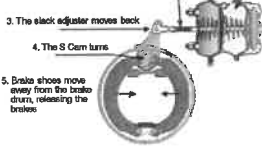
### Parking Brake Applied

1. A large spring pushes against a plate
2. It moves the pushrod out
3. Pushes on the slack adjuster
4. Turns the S Cam
5. Pushes the brake shoes against the brake drum



### Parking Brake Released

1. Air pressure pushes the spring back
2. The pushrod moves back
3. The slack adjuster moves back
4. The S Cam turns
5. Brake shoes move away from the brake drum, releasing the brakes




EVOC-Class B Module 2

## AIR BRAKES TRAVEL - SERVICE BRAKE

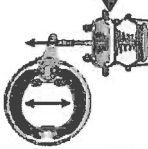
### Accelerating or Coasting

Air pressure disengages the parking/emergency brakes, so the wheels can turn. If air pressure is lost in this chamber, the spring will apply the brakes.



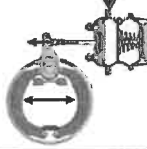
### Braking - Lag/Reaction Time

The brake pedal is pushed and air is forced into the service side brake chamber. The pushrod moves out, turning the slack adjuster and S cam.

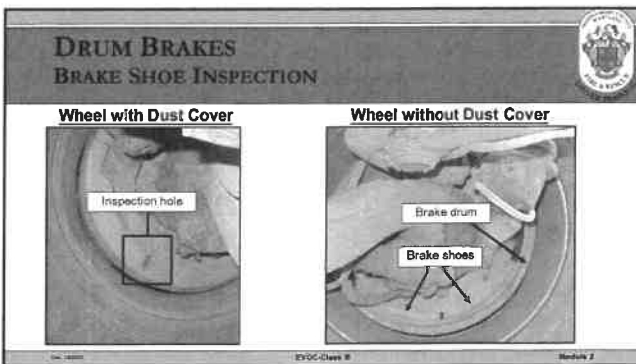
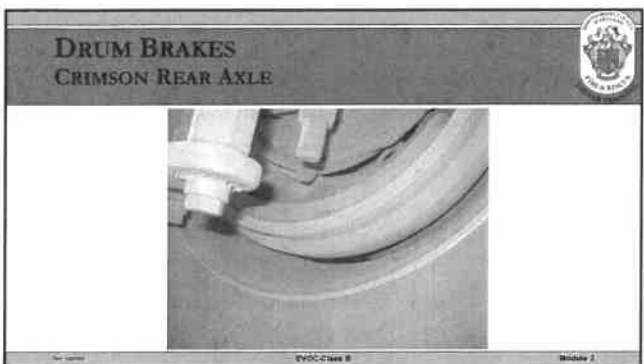
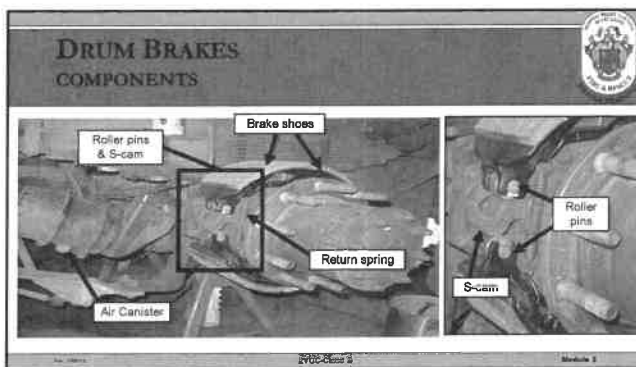
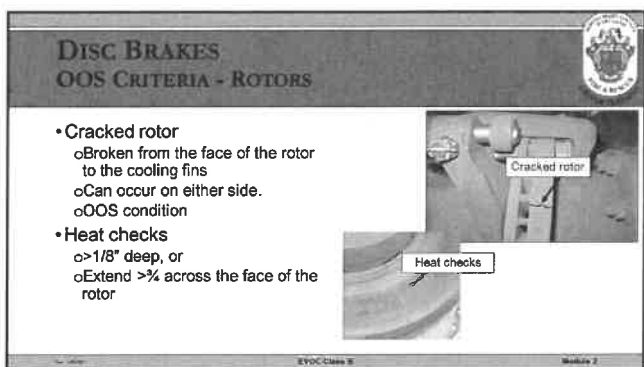
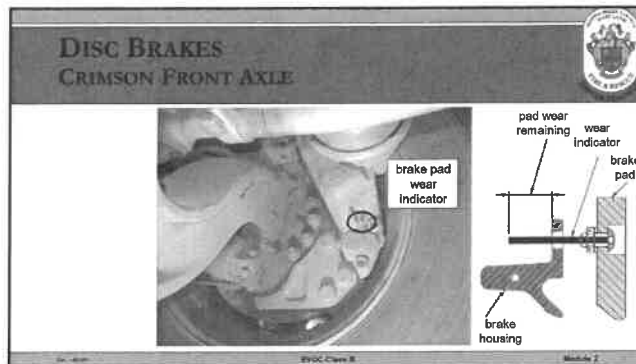
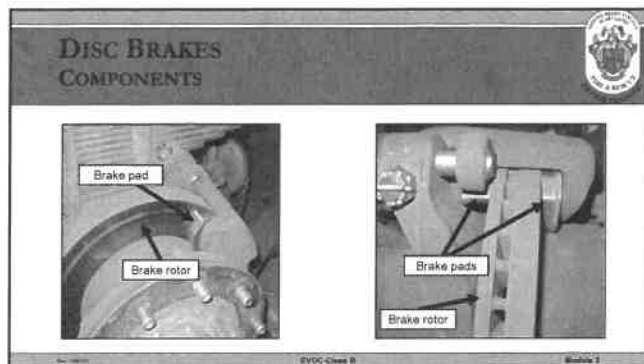


### Braking - Slowing/Stopping

The brake shoes are pushed against the brake drums causing the truck to slow.



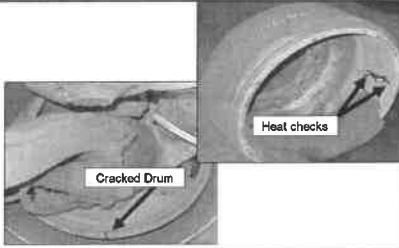
EVOC-Class B Module 2



### DRUM BRAKES

#### OOS CRITERIA - DRUMS

- Cracked drums
  - breaks that go thru the drum
  - crack expands when brake is applied
- Heat checks
  - $> \frac{1}{2}$  the width of the drum, and
  - $> \frac{1}{8}$ " deep




EVOC-Class B Module 2

### AIR BRAKES

#### EMERGENCY - LOSS OF AIR

If pressure is lost in the parking/emergency supply, then the spring brake will lock up the wheels.

If pressure is lost in the service supply, then the truck will have no service brakes. If this happens, use a combination of the auxiliary braking systems, transmission, and emergency brake to bring the truck to a stop.



EVOC-Class B Module 2

### AIR BRAKES

#### DOT INSPECTION


- Conducted in a specific sequence
  - Ensures all critical features are checked properly
- Incorrect sequence
  - Does not check operation of the system sufficiently
  - Will result in a failure during candidate exams - PAPS
- Requires a watch, phone, or other means to keep time
- Park on reasonably flat ground
- Place wheel chocks on both sides of a wheel
- Battery and ignition switches must be on for gauges and warning devices to operate

EVOC-Class B Module 2

### AIR BRAKES

#### DOT INSPECTION

1. Release the parking brake
  - a. Push valve in
  - b. Charges the system with air
2. Let pressure in storage tanks settle
3. Observe the air storage gauges for 1 minute
  - a.  $< 3$ psi loss ( $< 4$ psi for TDA)
4. Apply steady pressure to the brake pedal
5. Let pressure in the storage tanks settle




EVOC-Class B Module 2

### AIR BRAKES

#### DOT INSPECTION

6. Observe the air storage gauges for 1 minute
  - a.  $< 3$ psi loss ( $< 4$ psi for TDA)
7. Press and release the brake pedal repeatedly to bleed down the air storage tanks
  - a. Low air alarm must sound between 60 and 60psi
  - b. Parking brake must automatically engage at 20psi - valve pops out
8. Stop pressing the brake pedal once the parking brake engages
9. Start the motor and increase throttle to 1,200rpm
  - a. Pressure must increase from 50psi to 90psi in  $< 3$  minutes
  - b. Pressure must not exceed 135psi




EVOC-Class B Module 2

### AIR BRAKES

#### DOT INSPECTION

10. Ensure all systems and gauges are back to normal operating conditions
11. Remove the wheel chocks
12. Place the vehicle in forward or reverse gear at idle
  - a. Parking brake should restrain the vehicle from moving
13. End the test by engaging the parking brake and returning the transmission to neutral

- Report any defects to CMF as needed
  - Consult with CMF if the safety of the vehicle is in doubt



EVOC-Class B Module 2

### AIR BRAKES C-O-L-A

**C=Cut in Pressure**

- Indicates compressor is engaging properly
  - Motor running and fanning the service brake
  - Storage pressure drops until compressor engages >95psi
  - Cut-in pressure of <80psi is OOS criteria

**O=Cut out Pressure**

- Indicates governor is working properly and compressor is disengaging properly
  - Motor running and storage tank pressure rising
  - Compressor shuts off between 120 and 135psi
  - Listen for the air dryer to exhaust air
  - Cut-out pressure of >135psi is OOS criteria

EVOC-Class B Module 2

### AIR BRAKES C-O-L-A

**L=Low Pressure warning**

- Verifying that the low air alarms are functioning
  - Motor shut down but ignition on
  - Fan the service brakes to bleed storage tanks
  - Low air visual and audible alarms should engage 60 to 90psi
  - Alarms that do not engage <60psi are an OOS criteria

**A=Air Leakage rate**

- Assessing the ability of the entire system to hold air
  - Motor shut down
  - Monitor storage air levels for 1 minute
  - Levels should drop <3psi; or <4psi for tractor drawn vehicles

EVOC-Class B Module 2


### AIR BRAKES ANTI-LOCK BRAKING SYSTEMS

- Computer control over the air brake system
- Senses the status of each wheel independently
- Allow the tires to turn while the apparatus is slowing down – maintaining rolling friction with the road
- Stops the apparatus in the same – or shorter – distance than regular brakes
- Replaces skid reduction techniques of “pumping” or “threshold” braking
  - Brakes need to be firmly applied and held
  - ABS will NOT work if brakes are “pumped”

EVOC-Class B Module 2

### AIR BRAKES ANTI-LOCK BRAKING SYSTEMS

- Automatically returns full air pressure to the brakes when wheel speed is acceptable
- Any failure in the ABS is designed to return the affected wheel(s) to a non-ABS braking function
  - Should not result in complete loss of brakes
- Illuminated ABS warning light may be an OOS criteria



EVOC-Class B Module 2

### AIR BRAKES ANTI-LOCK BRAKING SYSTEMS

- Electronic Control Unit:** the brain of the ABS
  - Controls the air pressure to the brake chamber via the modulation valve
- Exciter or Pulse Ring:** attached to the axle or wheel hub turning at the same speed as the wheel
- Wheel Speed Sensor:** a small induction coil mounted in close proximity to the pulse ring
  - Generates an impulse to the electronic control unit, which determines the speed at which each wheel is turning.
- Modulation Valves:** control air pressure to the brake chambers on command from the electronic control unit
  - As quickly as 5 times per second - apply, release, or hold air pressure

EVOC-Class B Module 2



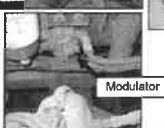
### AIR BRAKES ANTI-LOCK BRAKES

**Physical check**

- Loose or damaged wires
- Missing or damaged components

**Visual check**

- ABS warning light status






EVOC-Class B Module 2

### AIR BRAKES

#### THRESHOLD BRAKING

- Used to avoid skidding in vehicles *without* ABS
- Dependent upon the driver "feeling" the brakes
  - Pressure applied just prior to the wheels locking
- Pressure must be reduced if wheels lock
- Technique used for slippery conditions to maintain steering control while slowing
- Avoid "pumping" the brake pedal
  - Pumping can reduce available air pressure




Air Brakes
EVO-Class B
Module 2

### AIR BRAKES

#### BRAKE FADE


- A full stop at 60mph might raise the drum temperature 600°F
- Drums that reach 800-1000°F become subject to fade
  - Drum expand with the heat and require increased pushrod stroke
- Brake shoes and pads are essentially composed of glue and a binder material
  - With excessive heat the glue softens, starts to melt, and the face of the shoes or pads becomes slick
- Excessive heating may create conditions that exceed the pushrod stroke
  - combined drum expansion and shoe/pad failure



Air Brakes
EVO-Class B
Module 2

### BRAKE FAILURE


- Stay calm!
- Apply firm steady pressure to the pedal
- Shift to a lower gear
  - Downshift transmission by pressing the down arrow on the selector
- Ensure auxiliary braking systems are fully engaged
- Make small steering movements to create more friction with tires
- Rub tires against curb
- Look for an escape path that leads uphill or has a soft driving surface that will naturally slow the truck



Brake Failure
EVO-Class B
Module 2

### AUXILIARY BRAKING DEVICES

- Reduce need to apply service brakes
- Assist the service brakes in stopping the vehicle
- Systems in use in MCFRS
  - Jacobs Engine Brake
  - Telma Driveline Retarder
  - Allison Transmission Retarder
- Become familiar with the features of the specific apparatus you are driving




Auxiliary Braking Devices
EVO-Class B
Module 2

### AUXILIARY BRAKING DEVICES

#### JACOBS ENGINE BRAKE

- "Jake" brake
- Fully integrated into the motor cylinders
- Engages automatically when the accelerator is released
- Disengages when:
  - Accelerator is depressed, or
  - Motor speed falls below 1,000rpm
- Uses the motor to absorb energy instead of producing energy
  - is most effective in higher rpm ranges; 2,100+ rpm
  - <1,700rpm effectiveness greatly reduced
- Newer models are much quieter than old due to emissions standards




Auxiliary Braking Devices
EVO-Class B
Module 2

### AUXILIARY BRAKING DEVICES

#### JACOBS ENGINE BRAKE


- For dry weather and normal conditions, switch should be set to "high"
- For wet or slippery surfaces, gradually engage the engine brake starting at low and progressing to higher levels as wheel slip allows
  - Any fishtail or locking of the wheels mandates moving back to the last lower setting or turning the system off



Auxiliary Braking Devices
EVO-Class B
Module 2

### AUXILIARY BRAKING DEVICES TELMA RETARDER

- Mounted on the drive shaft near the rear axle
- Slows the rotation of the drive shaft through electromagnetic force
- Generates heat that is dissipated by the cooling vanes on the device
  - Have a history of overheating on some units
- Operates in four stages
  - Release the accelerator – stages 1 & 2
  - Depress the brake lightly – stage 3
  - Depress the brake hard – stage 4
- Slippery road conditions may require disengaging the device completely



[Telma Introduction Video](#)

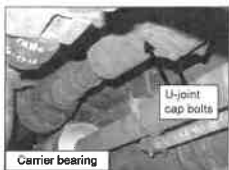
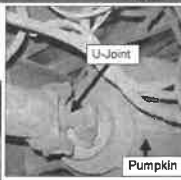
### AUXILIARY BRAKING SYSTEMS TRANSMISSION RETARDER

- FL80 chassis
- Vaned flywheel within transmission
- Oil directed into the flywheel to slow the transmission
- Heats up the transmission
  - Shift points become abrupt
  - Overheat condition can shut down the vehicle

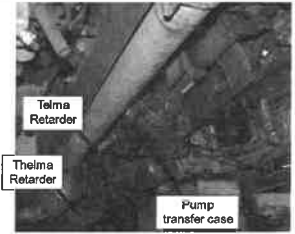

### OTHER COMPONENTS DRIVELINE

OOS Criteria

- Missing or broken bolts on the carrier bearing
- Missing or broken bolts in the U-joints
- Class 2 fluid leak at rear pumpkin

### OTHER COMPONENTS CRIMSON DRIVELINE


### ENGINE AFTERTREATMENT

- Enables compliance with EPA emissions standards – emergency vehicles are NOT exempt
- After 2006, all diesel exhaust systems have a particulate filter and associated regeneration system
  - Diesel Particulate Filter (DPF) captures soot and ash
  - Regeneration burns off the soot and ash that accumulates
- After 2009, aftertreatment systems include Diesel Exhaust Fluid (DEF) for additional treatment of exhaust gases
- There are two operator interventions necessary with these systems:
  - Active Regeneration – aka "parked" regeneration
  - Refilling the DEF tank

### DIESEL PARTICULATE FILTER HOW DOES IT WORK?

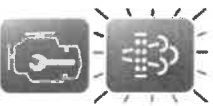


### DIESEL PARTICULATE FILTER INDICATOR LAMPS




**Aftertreatment Diesel Particulate Filter**

- Indicates a regeneration is needed – passive or active
- When flashing, regeneration is more urgently needed



**Flashing DPF Light + Check Engine**

- Regeneration is needed immediately
- Active regeneration is required



**High Exhaust System Temperature**

- Does not signify any need for service – regeneration occurs at high temperatures
- Keep the exhaust pipe outlet away from combustibles

### DIESEL PARTICULATE FILTER PASSIVE REGENERATION

- Occurs automatically as needed when driving over 40mph
  - Does not require any action on the part of the driver
- It is unlikely that MCFRS apparatus will drive enough highway miles for Passive Regeneration to complete its cycle


### DIESEL PARTICULATE FILTER ACTIVE REGENERATION – “PARKED REGEN”

- DPF lamp illuminates or flashes
- Determine a suitable location to park the apparatus
  - Away from combustibles or items that could be damaged by exhaust heat – need at least 5 feet of clearance
  - Outdoors and NOT connected to the PlymoVent
- After parking the unit, engage the manual regeneration
  - May be a toggle switch, rocker switch, or other control
  - Motor rpm should increase to approximately 1100rpm.
- The driver must remain with the vehicle during regeneration
  - Duration varies by amount of soot in the DPF – 5 to 20 minutes

### DIESEL PARTICULATE FILTER ACTIVE REGENERATION – “PARKED REGEN”

- Regeneration will stop:
  - Automatically when the motor controls sense the particulate filter is cleaned
  - Manually if the brake pedal is depressed
- Unit may remain in service during regen
- Regen may not engage when other vehicle functions are in use, i.e. pump, PTO, hydraulics – older generation vehicles
- Vehicle exhaust components will remain very hot following the regen process
  - High temperature light will illuminate

### DIESEL PARTICULATE FILTER ACTIVE REGENERATION – “PARKED REGEN”




**Do not perform regen inside a building or while attached to an exhaust removal system!**

**A minimum of 5 feet of clearance is required to the exhaust outlet.**

**When pumping it may be necessary to inhibit regen if clearances to the exhaust are not available!**

### ACTIVE REGENERATION PIERCE ENFORCER ENGINES

Prevents system from entering or continuing in active regeneration mode; used when regen may engage in an undesirable location



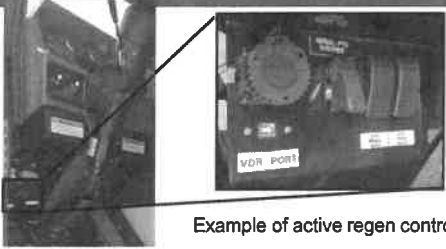
Used to manually initiate a parked regeneration; DPF lamp must be illuminated to engage

**Regeneration occurs:**

- When an intervention by the operator during travel or pumping operations creates correct conditions for regen
  - Requires sufficient exhaust flow and temperatures
  - Speedometer >5mph
  - NO engine speed variations will occur when pumping or driving
- Manually by activating the DPF Regen switch while parked

Regeneration will not effect motor RPM during pumping operations if it engages automatically.

### DIESEL PARTICULATE FILTER ACTIVE REGENERATION – “PARKED REGEN”




Example of active regen controls

### DIESEL EXHAUST FLUID (DEF) WHAT IS IT & WHAT DOES IT DO?

- Non-hazardous solution of 32.5% urea and 67.5% de-ionized water used in post-2009 diesel vehicles
- DEF is sprayed into the exhaust stream of diesel vehicles to break down NOx emissions into nitrogen and water
- DEF is **not a fuel additive** and never comes into contact with diesel
- DEF is stored in a separate tank, typically with a blue filler cap.

### DIESEL EXHAUST FLUID LEVELS & LOCATION



DEF fill located inside driver's side rear cab door

DEF fill co-located with driver's side diesel fill

DEF level display located above fuel gauge on dash, as a separate gauge, or within a vehicle system screen.

### DIESEL EXHAUST FLUID CONTAMINATION – FUEL VS. DEF

- Nozzle sizes
  - DEF nozzles are 0.75"; diesel nozzles are 0.87"
  - The diesel nozzle should not fit into the DEF tank
  - The cap for the DEF tank is blue and will be clearly marked
- Diesel in the DEF tank
  - Diesel will float on top of DEF
  - Small amounts of diesel can damage the exhaust system
  - If any fluid except DEF is poured into the DEF tank, contact CMF immediately and do not drive the vehicle.
- DEF in the fuel tank
  - The motor will stop running almost immediately, and the vehicle will require repair

### DIESEL EXHAUST FLUID SUPPLY, HANDLING, AND REFILL

- Stocked in 2.5 gallon containers with filler tubes
  - requested as needed through normal supply procedures
- DEF crystallizes when stored for prolonged periods as the water evaporates
  - Do not use DEF that shows signs of crystallization
  - Always completely use a container to avoid storing opened containers
- Refill when the level indicator reaches 1/2 or less
  - The tank should accept one full 2.5 gallon container of DEF
  - No need to continuously top off the DEF tank
- Filler tube is supplied with the case
- Spills can be safely washed down with water. DEF is not corrosive to human skin, however is corrosive to aluminum. Do not allow it to remain on the diamond tread.
- The freezing point of DEF is 12°F, however vehicles are equipped to thaw the DEF and this should not restrict use of the vehicle.
- Personal protective equipment is not necessary when handling DEF, however it will stain clothes.

### REAR AXLE DIFFERENTIALS

- The differential allows the wheels on the rear axle spin at different rates while the vehicle is turning
  - Permits tighter turning
  - Less wear and tear on the tires
- Differential Lock
  - Locks both sets of drive wheels together as if they were rotating on a solid shaft
  - Used during poor traction situations; without it one wheel may continue to spin with little torque transferred to the wheel with traction
  - Never engage >25mph or with wheels spinning
  - Disengage once traction is regained; do not use on dry pavement

## INTER-AXLE DIFFERENTIAL TANDEM AXLE APPARATUS

- Allows the wheels of either axle to revolve faster or slower than the wheels of the other axle
- Compensates for cornering, uneven road surfaces, and slightly different tire sizes
- Inter-axle Differential Lock
  - Sends equal power to all rear tires
  - Used during poor traction situations
  - Never engage while moving or with wheels spinning
  - Disengage once traction is regained; do not use on dry pavement



Stimulus 1

## AUTOMATED CONTROL FEATURES

### Automatic Traction Control (ATC)

- Automatically applies the service brake to the spinning wheel
- Transfers torque through the differential to the opposite wheel
  - If both wheels lose traction, the system reduces engine torque until traction is sensed
- If the vehicle is stuck and the ATC keeps reducing engine speed, disengage by pressing the "Mud/Snow Traction" or "Offroad Traction" switch on the dashboard

### Roll Stability Control (RSC)

- Senses lateral acceleration integral to the ABS
- Automatically adjusts vehicle components
  - ↓ Reduces engine torque
  - ↓ Engages engine brake or retarder
  - ↓ Applying the service brakes



\_\_\_\_\_

## AUTOMATED CONTROL FEATURES

- **Electronic Stability Control (ESC)**
  - Pierce Enforcer feature
  - stabilizes the vehicle during cornering maneuvers
  - Compares where you are steering and where the vehicle is actually going
  - Intervenes by applying the brakes to individual wheels asymmetrically in order to create torque about the vehicle's vertical axis
  - system may reduce engine power or operate the transmission to slow the vehicle down

1999

## VEHICLE DIAGNOSTICS

### PIERCE ENFORCER ENGINES

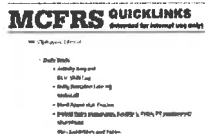
- Command Zone offers layers of vehicle system status
- Command Zone displays engine hours and pump hours needed for defect reporting



**Abstract**

## DEFECT REPORTING FLEET MANAGEMENT REPORTING SYSTEM

- Requires employee ID # and password
  - Not the same as single sign-in or network info
- Statistics are required to complete the online report
  - Vehicle mileage
  - Engine Hours
  - Pump Hours
  - Generator Hours
- Enter only one defect per report
  - Provide a detailed description of the issue
  - Include photos when applicable
- Permits the operator to see what defects exist and who reported them when

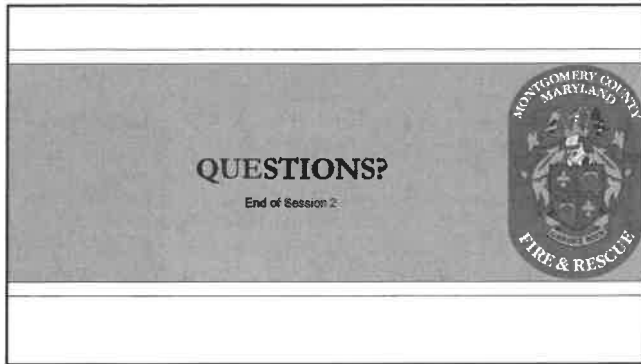


Monday 9

### ADDITIONAL RESOURCES

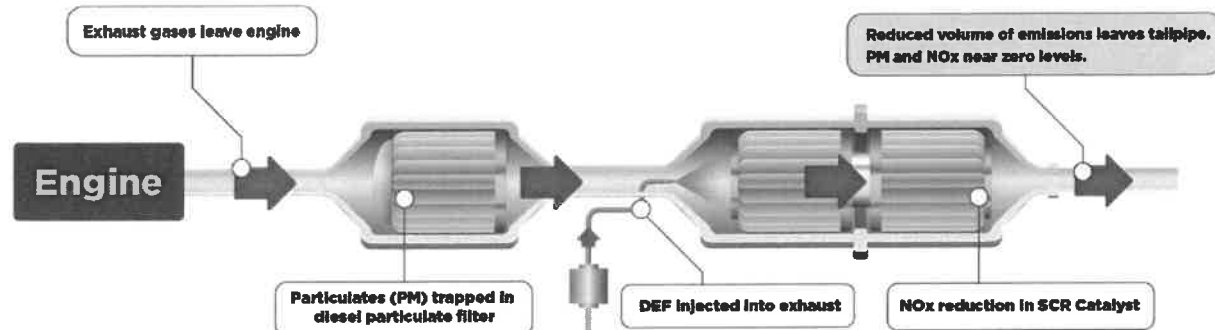
- **MCFRS Operator's Guide to Fire Apparatus Out of Service Criteria**  
<http://www.montgomerycountymd.gov/frs-gl/resources/files/apparatus/MCFRISOOSCriteria12.pdf>
- **PSTA Driver Training Website**
- **MCFRS Apparatus Checkout Form**  
<http://www.montgomerycountymd.gov/frs-gl/resources/files/apparatus/checkout/ApparatusCheckout.pdf>

9247-06



# Diesel Exhaust After-Treatments

## Diesel Emissions Control System



### Diesel Particulate Filter (DPF)

A diesel particulate filter (DPF) is a device integrated into an exhaust system to remove diesel particulate matter or soot from the exhaust gas of a diesel engine. They are capable of removing 85% or more of the soot. DPF on MCFRS apparatus are designed to burn off the accumulated particulate by heating the filter to soot combustion temperatures. This is accomplished by engine programming to run (when the filter is full) in a manner that elevates exhaust temperature, in conjunction with an extra fuel injector in the exhaust stream that injects fuel to react with a catalyst element to burn off accumulated soot in the DPF filter. This is known as filter regeneration. Regeneration processes vary in duration in correlation to the level of accumulated soot, however generally last 5 to 20 minutes. Failure of fuel injectors or turbochargers resulting in contamination of the filter with raw diesel or engine oil can necessitate disassembly and cleaning by a service contractor.

Passive regeneration occurs at road speeds higher than can generally be attained on city streets. This was designed for over-the-road trucks that regularly operate on highways for prolonged periods and occurs without driver intervention, hence the term "passive".

Vehicles driven exclusively at low speeds in urban traffic, such as fire apparatus or ambulances, have two options for completing regeneration. They can complete periodic trips at higher speeds to clean out the DPF which may or may not be a practical option due to the speeds and duration required. The speed must remain above 40mph until the passive regeneration process is complete, which can be difficult simply due to traffic conditions in Montgomery County.

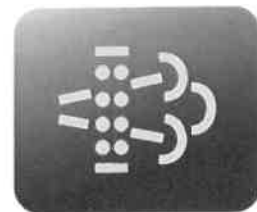
The more likely option for MCFRS apparatus is an active regeneration, or "parked" regeneration, that requires intervention by the driver. Drivers should refer to their specific apparatus operations manuals to identify the dashboard indicator lights and

controls related to completing active regeneration. Each apparatus has specific switches or controls to engage the regeneration, however there are some general characteristics that apply to all regeneration processes:

- The regeneration process causes very high exhaust temperatures ( $>1,300^{\circ}\text{F}$ ). Do not park the apparatus with the exhaust discharge near combustible materials or next to other vehicles or objects. The heat will damage paint and/or ignite landscaping materials. As a general rule, a minimum of five feet of clearance is required. Beware that exhaust components will remain hot for some time following regeneration.
- Regeneration should always occur outdoors. Do not attempt regeneration with the apparatus connected to a PlymoVent or similar exhaust removal system that contacts the tailpipe. The regeneration process may also create more smoke than normal, so even non-contact exhaust removal systems may not be sufficient to control the indoor exhaust.
- The process may be interrupted if the vehicle needs to be moved, i.e. the unit must respond to an incident. The interruption occurs automatically when the vehicle parking brake is release, the service brake is depressed, the transmission is placed in drive, and/or the system senses that the particulate filter is cleaned.
- The regeneration process will normally be locked out when auxiliary vehicle functions connected to the motor or transmission are engaged. This includes the PTO, fire pump, and/or hydraulic generators. This ensures no interference with incident scene operations.
- Active regeneration occurs with the motor increasing to 1,100 to 1,400 rpm. If the vehicle returns to normal idle this is a sign that regeneration has completed.



If the warning light is ignored and regeneration is not completed in a timely manner, the DPF may not automatically regenerate properly resulting in the motor to automatically reduce power and/or shut down completely. Generally, the DPF warning light will initially be in a steady illumination state and progress to a flashing warning as regeneration becomes more critical. In extreme cases, the DPF may have to be completely replaced before the motor will run again. The sooner active regeneration occurs after the warning light becomes illuminated the quicker the regeneration process will complete.



## Diesel Exhaust Fluid (DEF)

Diesel Exhaust Fluid (DEF) is present in post-2009 diesel vehicles equipped with Selective Catalytic Reduction (SCR). The SCR injects DEF into a catalyst to break down nitrogen oxide emissions into nitrogen and water.

DEF is a non-hazardous solution of 32.5% urea and 67.5% de-ionized water. Similar to the DPF, any warning lights associated with the DEF should not be ignored. An empty DEF tank will result in the vehicle limiting itself or shutting down.

DEF is **not a fuel additive** and **never comes into contact with diesel**. DEF should NEVER be poured into a fuel tank. It is stored in a separate tank, typically with a blue filler cap that is clearly marked.

The standard nozzle diameter for DEF is 0.75", compared to 0.87" for diesel, preventing the diesel nozzle from ever being inserted into the DEF tank. In addition, the filling cap for the DEF tank is blue and will be clearly marked.

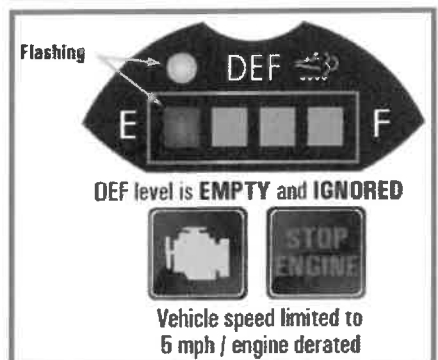
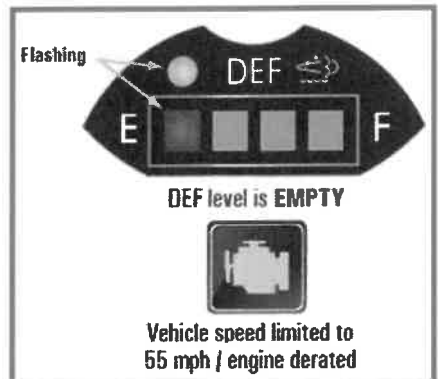
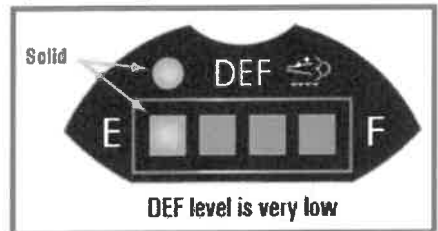
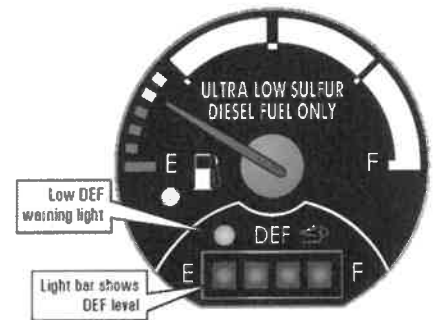
- ✦ Diesel is less dense than DEF and will float on top of the DEF in the tank, but even small amounts of diesel can damage the exhaust system. **If any fluid except DEF is poured into the DEF tank, contact CMF immediately and do not drive the vehicle.**
- ✦ **If DEF is poured into the diesel tank, the engine will stop running almost immediately, and the vehicle will require repair.**

### Supply and Refilling

CMF stocks DEF in 2.5 gallon containers with filler tubes. DEF may be requested as needed through normal supply procedures. Some fire stations are equipped with larger drums of DEF that may be pumped into vehicles.

DEF crystallizes when stored for prolonged periods as the water evaporates. Do not use DEF that shows signs of crystallization and always completely use a 2.5 gallon container to avoid storing opened containers.

Refill DEF only when the level indicator reaches 1/2 or less. At that point, the tank should accept one full 2.5 gallon container of DEF. *There is no need to continuously top off the DEF tank.*



Use the filler tube supplied with the case to avoid spills or splashes. Spills can be safely washed down with water. DEF is not corrosive to human skin, however is corrosive to aluminum. Do not allow it to remain on the diamond tread.

The freezing point of DEF is 12°F, however vehicles are equipped to thaw the DEF in its tank and this should not restrict use of the vehicle.

Personal protective equipment is not necessary when handling DEF, however it will stain clothes.



## **Driver Tips For Fire And Emergency Vehicles.**

For EPA 2013 Cummins On-Highway Heavy-Duty  
And MidRange Engines With Aftertreatment.



This guide covers engine, aftertreatment and emissions-related indicator lamps\* found on your vehicle's instrument panel and explains what they mean and the actions drivers need to take when the lamps illuminate. Important information about fuel, oil, Diesel Exhaust Fluid (DEF) and operating tips is also included.

The information in this tips card is specific to Cummins-powered fire and emergency vehicles. If you need information regarding other on-highway applications, please reference Bulletin 4971518.

## General Engine Indicator Lamps.



### Check Engine Lamp Or Amber Warning Lamp

The Check Engine Lamp (which may also be referred to as the Amber Warning Lamp) illuminates when the engine needs to be serviced at the first available opportunity.



### Stop Engine Lamp

The red Stop Engine Lamp indicates, when illuminated, that the vehicle needs to be stopped as soon as it is safe to do so.

## On-Board Diagnostics.

Starting in 2013, all on-highway engines include On-Board Diagnostics as a part of the emissions regulation requirement. On-Board Diagnostics monitors all emissions-related engine systems during operation. If the system detects any emissions-related malfunctions, it will alert the operator to these detected malfunctions through a dash lamp known as the Malfunction Indicator Lamp (MIL).



### Malfunction Indicator Lamp (MIL)

The MIL illuminates when the On-Board Diagnostics system detects a malfunction related to the emissions control system. The illuminated MIL indicates that the engine and aftertreatment system should be diagnosed and serviced at your next available opportunity. The MIL can be illuminated along with any of the engine indicator lamps.



If the MIL is illuminated with the red Stop Engine Lamp, the vehicle should be stopped as soon as it is safe to do so. It should then be taken to an authorized Cummins location for repair.

\*Lamps shown are for illustrative purposes only. Be sure to reference your vehicle manufacturer's Owners Manual for specific lamps and details.

## Diesel Exhaust Fluid For Selective Catalytic Reduction (SCR) Aftertreatment.

Every vehicle with a U.S. Environmental Protection Agency (EPA) 2010 or newer engine has an on-frame storage tank for Diesel Exhaust Fluid (DEF) and a dash lamp that indicates low DEF levels. Refilling this tank with DEF is critical in order for your vehicle to comply with EPA emissions regulations.

### Diesel Exhaust Fluid (DEF) Lamp



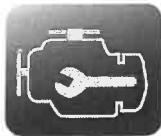
#### *Illuminated*

An illuminated DEF Lamp is an indication that the DEF level is low. This can be corrected by refilling the DEF tank with Diesel Exhaust Fluid.



#### *Flashing*

A flashing DEF Lamp indicates that the DEF level has fallen below a critical level. This can be corrected by refilling the DEF tank.



#### *Flashing DEF Lamp With Check Engine Lamp/ Amber Warning Lamp*

A flashing DEF Lamp combined with an illuminated Check Engine Lamp/Amber Warning Lamp indicates that the DEF level is critically low. This can be corrected by refilling the DEF tank.

## Emissions Derate Exemptions.

Cummins EPA 2013 and newer diesel engines for fire and emergency vehicles should not experience any emissions-related vehicle speed or engine torque derates. To determine if there are calibration updates applicable to your engine, contact Cummins Care at 1-800-DIESELS™ (1-800-343-7357) with your Engine Serial Number (ESN). Visit [cumminsengines.com/fire-and-emergency](http://cumminsengines.com/fire-and-emergency) for more details and information on engines built prior to 2013.

## Diesel Particulate Filter (DPF).

The DPF is an integral component of the aftertreatment system on vehicles equipped with EPA 2007 and newer engines, excluding some EPA 2007 ISM engines. It captures Particulate Matter (PM) in a wall-flow ceramic filter. The exhaust system periodically undergoes regeneration, raising temperatures to oxidize captured PM and clean the system. Lamps alert the driver when a regeneration is needed.



### High Exhaust System Temperature (HEST) Lamp

The HEST Lamp illuminates to indicate that high exhaust temperatures may exist due to aftertreatment regeneration. This is normal, and does not signify the need for any kind of vehicle service or engine service. When this lamp is illuminated, ensure that the exhaust pipe outlet is not directed at any combustible surface or material. Reference your Cummins Owners Manual for complete instructions.



### Aftertreatment Diesel Particulate Filter (DPF) Lamp

#### *Illuminated*

The Aftertreatment DPF Lamp indicates, when illuminated or flashing, that the Aftertreatment DPF requires regeneration. This is accomplished by the following:

1. If the vehicle is equipped with a Regeneration Inhibit Switch, ensure that the switch is not in the Inhibit position.
2. Perform a DPF regeneration by one of the following methods:
  - a. Change to a more challenging duty cycle – such as highway driving – for at least 20 minutes to increase exhaust temperatures.OR
  - b. Perform a parked regeneration.



#### *Flashing*

If a regeneration is not performed in a timely manner after the DPF Lamp is illuminated, the DPF Lamp will begin to flash. This indicates a higher level of PM in the DPF.



#### *Flashing With Check Engine Lamp/Amber Warning Lamp*

A flashing DPF Lamp combined with an illuminated Check Engine Lamp/Amber Warning Lamp indicates that the aftertreatment DPF needs regeneration immediately. A parked regeneration is required.



#### *Stop Engine Lamp*

If a parked regeneration is not performed, the red Stop Engine Lamp will illuminate. As soon as it is safe to do so, the vehicle should be stopped. It should then be taken to an authorized Cummins location for repair.

Note: Cummins engines calibrated for emergency vehicle use are programmed to not reduce power or speed due to soot load. However, excessive soot load may impact engine performance.

### Regeneration Inhibit Switch

The purpose of this switch is to prevent or disable active aftertreatment DPF regeneration. Reference the vehicle Owners Manual for complete operation and use of this switch. Unnecessary or excessive use of the Regeneration Inhibit Switch will result in a loss of fuel economy, or an increased need for parked regeneration.

## How To Perform A Parked (Stationary) Regeneration.

If the vehicle has a Manual Regeneration Switch and the DPF Lamp is illuminated or flashing:

- Park vehicle in an appropriate location, set parking brake and place transmission in Park (if provided) or Neutral, and allow up to one hour for the regeneration.
- Set up a safe exhaust area. Confirm that nothing is on or near the exhaust system surfaces.
- Ensure that your fast-idle and power take-off (PTO) switches are off before starting regeneration.
- Push the Manual Regeneration Switch to begin a parked regeneration. Note: Engine speed will increase, and there may be a noticeable change to the sound of the turbocharger during the regeneration process. Once the DPF is regenerated, the engine will automatically return to the normal idle speed.
- Monitor the vehicle and surrounding area during regeneration. If any unsafe condition occurs, shut off the engine immediately. To stop a parked regeneration, depress the brake or throttle pedal.
- Once regeneration is complete, exhaust gas and exhaust surface temperatures will remain elevated for three to five minutes.

Reference your Cummins Owners Manual and vehicle Owners Manual for complete operating instructions.

## Fuel, Oil And DEF.

- Use only Ultra-Low Sulfur Diesel (ULSD) fuel.
- CJ-4 (low ash) is the recommended oil.
- Be sure to check the DEF gauge at every refueling. Cummins recommends topping off the DEF tank when refueling. DEF meeting ISO 22241-1 must be used.
- Please read your vehicle manufacturer's Owners Manual to familiarize yourself with the location and capacity of the DEF tank.
- Put only DEF in the DEF tank, which has a blue cap.

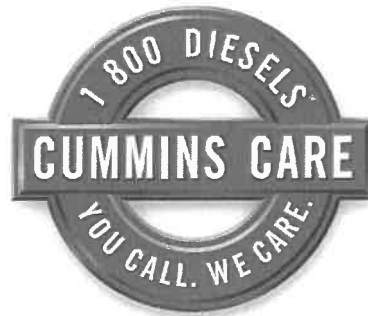


## Items Driver Will Notice.

- Under certain conditions (cold or very dry), condensation in the form of water vapor can be seen coming from the vehicle tailpipe. This is normal. It will clear within a few minutes of normal vehicle operation.
- If the engine is left at idle for significant periods of time without reaching the minimum exhaust operating temperatures, the engine will automatically increase the engine idle speed for several minutes to maintain the condition of the particulate filter. This can be interrupted by pressing the service brake.
- After prolonged idle, you may notice momentary white vapor and an odor. This is normal.
- When the High Exhaust System Temperature Lamp is illuminated, you may notice an odor. This is normal. If the odor is excessive and you also notice white vapor, have the exhaust system inspected for leaks.

## Cummins Care.

Our authorized service technicians are fully trained to promptly handle any type of service issue. Call Cummins Care at 1-800-DIESELS™ (1-800-343-7357), and representatives will be available to answer product questions and provide assistance during a repair or service event.



**Cummins Inc.**  
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## Section 5

# AIR BRAKES

### This Section Covers

- Air Brake System Parts
- Dual Air Brake Systems
- Inspecting Air Brakes
- Using Air Brakes

This section tells you about air brakes. If you want to drive a truck or bus with air brakes, or pull a trailer with air brakes, you need to read this section. If you want to pull a trailer with air brakes, you also need to read Section 6, Combination Vehicles.

Air brakes use compressed air to make the brakes work. Air brakes are a good and safe way of stopping large and heavy vehicles, but the brakes must be well maintained and used properly.

Air brakes are really three different braking systems: service brake, parking brake, and emergency brake.

- The service brake system applies and releases the brakes when you use the brake pedal during normal driving.
- The parking brake system applies and releases the parking brakes when you use the parking brake control.
- The emergency brake system uses parts of the service and parking brake systems to stop the vehicle in a brake system failure.

The parts of these systems are discussed in greater detail below.

### 5.1 – The Parts of an Air Brake System

There are many parts to an air brake system. You should know about the parts discussed here.

#### 5.1.1 – Air Compressor

The air compressor pumps air into the air storage tanks (reservoirs). The air compressor is connected to the engine through gears or a v-belt. The compressor may be air cooled or may be cooled by the engine cooling system. It may have its own oil supply or be lubricated by engine oil. If the compressor has its own oil supply, check the oil level before driving.

#### 5.1.2 – Air Compressor Governor

The governor controls when the air compressor will pump air into the air storage tanks. When air tank pressure rises to the “cut-out” level (around 125 pounds per-square-inch or “psi”), the governor stops the compressor from pumping air. When the tank pressure falls to the “cut-in” pressure (around 100 psi), the governor allows the compressor to start pumping again.

#### 5.1.3 – Air Storage Tanks

Air storage tanks are used to hold compressed air. The number and size of air tanks varies among vehicles. The tanks will hold enough air to allow the brakes to be used several times, even if the compressor stops working.

#### 5.1.4 – Air Tank Drains

Compressed air usually has some water and some compressor oil in it, which is bad for the air brake system. For example, the water can freeze in cold weather and cause brake failure. The water and oil tend to collect in the bottom of the air tank. Be sure that you drain the air tanks completely. Each air tank is equipped with a drain valve in the bottom. There are two types:

- Manually operated by turning a quarter turn or by pulling a cable. You must drain the tanks yourself at the end of each day of driving. See Figure 5.1.
- Automatic--the water and oil are automatically expelled. These tanks may be equipped for manual draining as well.

Automatic air tanks are available with electric heating devices. These help prevent freezing of the automatic drain in cold weather.

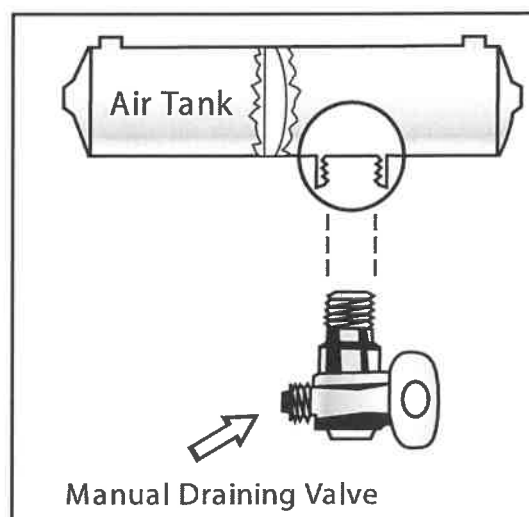


Figure 5.1

### 5.1.5 – Alcohol Evaporator

Some air brake systems have an alcohol evaporator to put alcohol into the air system. This helps to reduce the risk of ice in air brake valves and other parts during cold weather. Ice inside the system can make the brakes stop working.

Check the alcohol container and fill up as necessary, every day during cold weather. Daily air tank drainage is still needed to get rid of water and oil. (Unless the system has automatic drain valves.)

### 5.1.6 – Safety Valve

A safety relief valve is installed in the first tank the air compressor pumps air to. The safety valve protects the tank and the rest of the system from too much pressure. The valve is usually set to open at 150 psi. If the safety valve releases air, something is wrong. Have the fault fixed by a mechanic.

### 5.1.7 – The Brake Pedal

You put on the brakes by pushing down the brake pedal. (It is also called the foot valve or treadle valve.) Pushing the pedal down harder applies more air pressure. Letting up on the brake pedal reduces the air pressure and releases the brakes. Releasing the brakes lets some compressed air go out of the system, so the air pressure in the tanks is reduced. It must be made up by the air compressor. Pressing and releasing the pedal unnecessarily can let air out faster than the compressor can replace it. If the pressure gets too low, the brakes won't work.

### 5.1.8 – Foundation Brakes

Foundation brakes are used at each wheel. The most common type is the s-cam drum brake. The parts of the brake are discussed below.

**Brake Drums, Shoes, and Linings.** Brake drums are located on each end of the vehicle's axles. The wheels are bolted to the drums. The braking mechanism is inside the drum. To stop, the brake shoes and linings are pushed against the inside of the drum. This causes friction, which slows the vehicle (and creates heat). The heat a drum can take without damage depends on how hard and how long the brakes are used. Too much heat can make the brakes stop working.

**S-cam Brakes.** When you push the brake pedal, air is let into each brake chamber. Air pressure pushes the rod out, moving the slack adjuster, thus twisting the brake camshaft. This turns the s-cam (so called

because it is shaped like the letter "S"). The s-cam forces the brake shoes away from one another and presses them against the inside of the brake drum.

When you release the brake pedal, the s-cam rotates back and a spring pulls the brake shoes away from the drum, letting the wheels roll freely again. See Figure 5.2.

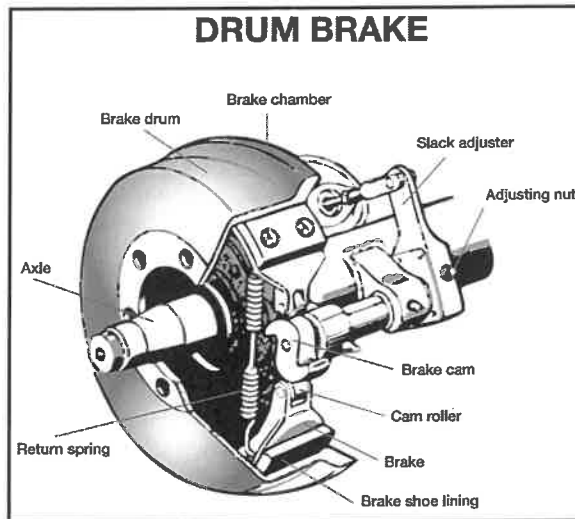


Figure 5.2

**Wedge Brakes.** In this type of brake, the brake chamber push rod pushes a wedge directly between the ends of two brake shoes. This shoves them apart and against the inside of the brake drum. Wedge brakes may have a single brake chamber, or two brake chambers, pushing wedges in at both ends of the brake shoes. Wedge type brakes may be self-adjusting or may require manual adjustment.

**Disc Brakes.** In air-operated disc brakes, air pressure acts on a brake chamber and slack adjuster, like s-cam brakes. But instead of the s-cam, a "power screw" is used. The pressure of the brake chamber on the slack adjuster turns the power screw. The power screw clamps the disc or rotor between the brake lining pads of a caliper, similar to a large c-clamp.

Wedge brakes and disc brakes are less common than s-cam brakes.

### 5.1.9 – Supply Pressure Gauges

All vehicles with air brakes have a pressure gauge connected to the air tank. If the vehicle has a dual air brake system, there will be a gauge for each half of the system. (Or a single gauge with two needles.) Dual systems will be discussed later. These gauges tell you how much pressure is in the air tanks.

### 5.1.10 – Application Pressure Gauge

This gauge shows how much air pressure you are applying to the brakes. (This gauge is not on all vehicles.) Increasing application pressure to hold the same speed means the brakes are fading. You should slow down and use a lower gear. The need for increased pressure can also be caused by brakes out of adjustment, air leaks, or mechanical problems.

### 5.1.11 – Low Air Pressure Warning

A low air pressure warning signal is required on vehicles with air brakes. A warning signal you can see must come on before the air pressure in the tanks falls below 60 psi. (Or one half the compressor governor cutout pressure on older vehicles.) The warning is usually a red light. A buzzer may also come on.

Another type of warning is the “wig wag.” This device drops a mechanical arm into your view when the pressure in the system drops below 60 psi. An automatic wig wag will rise out of your view when the pressure in the system goes above 60 psi. The manual reset type must be placed in the “out of view” position manually. It will not stay in place until the pressure in the system is above 60 psi.

On large buses it is common for the low pressure warning devices to signal at 80-85 psi.

### 5.1.12 – Stop Light Switch

Drivers behind you must be warned when you put your brakes on. The air brake system does this with an electric switch that works by air pressure. The switch turns on the brake lights when you put on the air brakes.

### 5.1.13 – Front Brake Limiting Valve

Some older vehicles (made before 1975) have a front brake limiting valve and a control in the cab. The control is usually marked “normal” and “slippery.” When you put the control in the “slippery” position, the limiting valve cuts the “normal” air pressure to the front brakes by half. Limiting valves were used to reduce the chance of the front wheels skidding on slippery surfaces. However, they actually reduce the stopping power of the vehicle. Front wheel braking is good under all conditions. Tests have shown front wheel skids from braking are not likely even on ice. Make sure the control is in the “normal” position to have normal stopping power.

Many vehicles have automatic front wheel limiting valves. They reduce the air to the front brakes except when the brakes are put on very hard (60 psi or more application pressure). These valves cannot be controlled by the driver.

### 5.1.14 – Spring Brakes

All trucks, truck tractors, and buses must be equipped with emergency brakes and parking brakes. They must be held on by mechanical force (because air pressure can eventually leak away). Spring brakes are usually used to meet these needs. When driving, powerful springs are held back by air pressure. If the air pressure is removed, the springs put on the brakes. A parking brake control in the cab allows the driver to let the air out of the spring brakes. This lets the springs put the brakes on. A leak in the air brake system, which causes all the air to be lost, will also cause the springs to put on the brakes.

Tractor and straight truck spring brakes will come fully on when air pressure drops to a range of 20 to 45 psi (typically 20 to 30 psi). Do not wait for the brakes to come on automatically. When the low air pressure warning light and buzzer first come on, bring the vehicle to a safe stop right away, while you can still control the brakes.

The braking power of spring brakes depends on the brakes being in adjustment. If the brakes are not adjusted properly, neither the regular brakes nor the emergency/parking brakes will work right.

### 5.1.15 – Parking Brake Controls

In newer vehicles with air brakes, you put on the parking brakes using a diamond-shaped, yellow, push-pull control knob. You pull the knob out to put the parking brakes (spring brakes) on, and push it in to release them. On older vehicles, the parking brakes may be controlled by a lever. Use the parking brakes whenever you park.

**Caution.** Never push the brake pedal down when the spring brakes are on. If you do, the brakes could be damaged by the combined forces of the springs and the air pressure. Many brake systems are designed so this will not happen. But not all systems are set up that way, and those that are may not always work. It is much better to develop the habit of not pushing the brake pedal down when the spring brakes are on.

**Modulating Control Valves.** In some vehicles a control handle on the dash board may be used to apply the spring brakes gradually. This is called a modulating valve. It is spring-loaded so you have a feel for the braking action. The more you move the control lever, the harder the spring brakes come on. They work this way so you can control the spring brakes if the service brakes fail. When parking a vehicle with a modulating control valve, move the lever as far as it will go and hold it in place with the locking device.

**Dual Parking Control Valves.** When main air pressure is lost, the spring brakes come on. Some vehicles, such as buses, have a separate air tank which can be used to release the spring brakes. This is so you can move the vehicle in an emergency. One of the valves is a push-pull type and is used to put on the spring brakes for parking. The other valve is spring loaded in the “out” position. When you push the control in, air from the separate air tank releases the spring brakes so you can move. When you release the button, the spring brakes come on again. There is only enough air in the separate tank to do this a few times. Therefore, plan carefully when moving. Otherwise, you may be stopped in a dangerous location when the separate air supply runs out. See Figure 5.3.

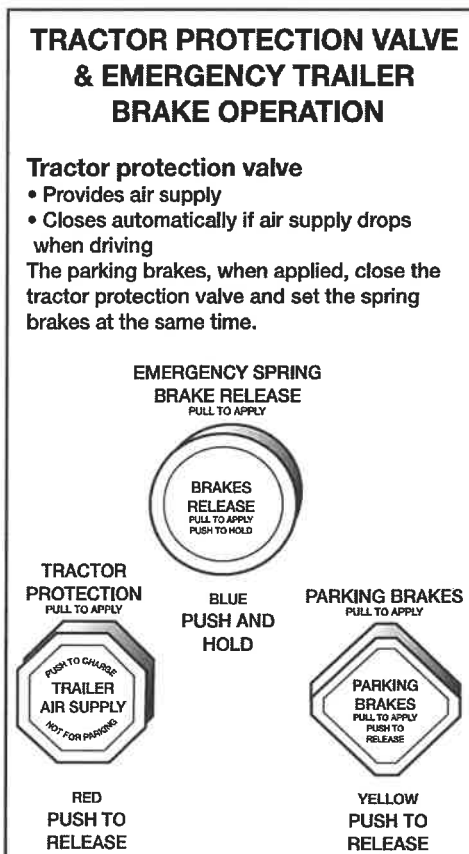


Figure 5.3

### 5.1.16 – Antilock Braking Systems (ABS)

Truck tractors with air brakes built on or after March 1, 1997, and other air brakes vehicles, (trucks, buses, trailers, and converter dollies) built on or after March 1, 1998, are required to be equipped with antilock brakes. Many commercial vehicles built before these dates have been voluntarily equipped with ABS. Check the certification label for the date of manufacture to determine if your vehicle is equipped with ABS. ABS is a computerized system that keeps your wheels from locking up during hard brake applications.

Vehicles with ABS have yellow malfunction lamps to tell you if something isn't working.

Tractors, trucks, and buses will have yellow ABS malfunction lamps on the instrument panel.

Trailers will have yellow ABS malfunction lamps on the left side, either on the front or rear corner. Dollies manufactured on or after March 1, 1998 are required to have a lamp on the left side.

On newer vehicles, the malfunction lamp comes on at start-up for a bulb check, and then goes out quickly. On older systems, the lamp could stay on until you are driving over five mph.

If the lamp stays on after the bulb check, or goes on once you are under way, you may have lost ABS control at one or more wheels.

In the case of towed units manufactured before it was required by the Department of Transportation, it may be difficult to tell if the unit is equipped with ABS. Look under the vehicle for the electronic control unit (ECU) and wheel speed sensor wires coming from the back of the brakes.

ABS is an addition to your normal brakes. It does not decrease or increase your normal braking capability. ABS only activates when wheels are about to lock up.

ABS does not necessarily shorten your stopping distance, but it does help you keep the vehicle under control during hard braking.

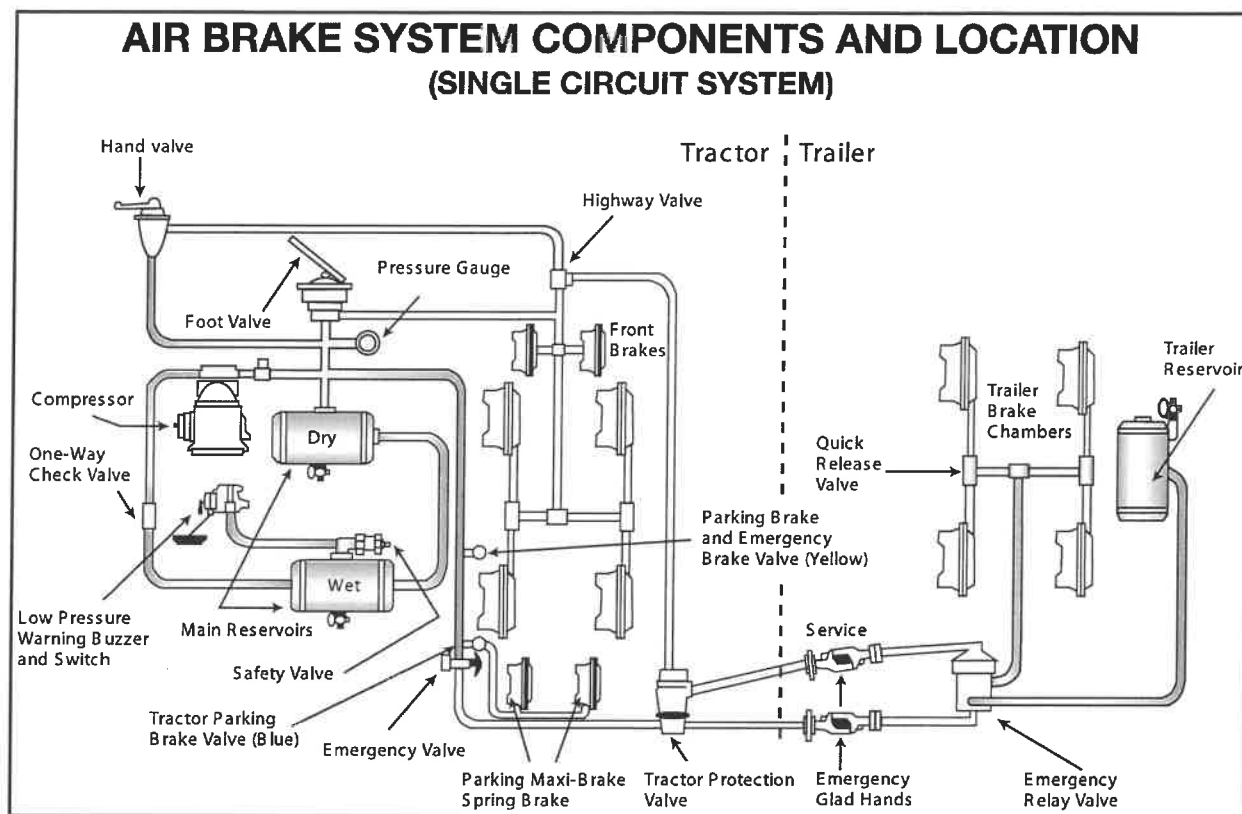


Figure 5.4

### Subsection 5.1 Test Your Knowledge

1. Why must air tanks be drained?
2. What is a supply pressure gauge used for?
3. All vehicles with air brakes must have a low air pressure warning signal. True or False?
4. What are spring brakes?
5. Front wheel brakes are good under all conditions. True or False?
6. How do you know if your vehicle is equipped with antilock brakes?

These questions may be on your test. If you can't answer them all, re-read subsection 5.1.

## 5.2 – Dual Air Brake

Most heavy-duty vehicles use dual air brake systems for safety. A dual air brake system has two separate air brake systems, which use a single set of brake controls. Each system has its own air tanks, hoses, lines, etc. One system typically operates the regular brakes on the rear axle or axles. The other system operates the regular brakes

on the front axle (and possibly one rear axle). Both systems supply air to the trailer (if there is one). The first system is called the "primary" system. The other is called the "secondary" system. See Figure 5.4.

Before driving a vehicle with a dual air system, allow time for the air compressor to build up a minimum of 100 psi pressure in both the primary and secondary systems. Watch the primary and secondary air pressure gauges (or needles, if the system has two needles in one gauge). Pay attention to the low air pressure warning light and buzzer. The warning light and buzzer should shut off when air pressure in both systems rises to a value set by the manufacturer. This value must be greater than 60 psi.

The warning light and buzzer should come on before the air pressure drops below 60 psi in either system. If this happens while driving, you should stop right away and safely park the vehicle. If one air system is very low on pressure, either the front or the rear brakes will not be operating fully. This means it will take you longer to stop. Bring the vehicle to a safe stop, and have the air brakes system fixed.





## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

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## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Driving and Crew Areas, Apparatus Body, and Compartmentation**

The following defects and deficiencies of the driving and crew areas, the apparatus body, and the compartmentation reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Body mounting that is defective
- ☐ Cab mounting that is defective
- ☐ Seat belts that are torn or have melted webbing, missing or broken buckles, or loose mountings. Due to the extreme safety-related consequences of a defective seat belt, and the fact that one defective seat belt (unless it is the driver's seat belt) does not render a piece of apparatus unusable, the authority having jurisdiction shall take any seating position with a defective seat belt out of service. (All assigned riding positions must have operable seat belts.)
- ☐ Cracked or broken windshield that obstructs the driver's/operator's view
- ☐ Missing or broken rearview mirrors that obstruct the driver's/operator's view
- ☐ Windshield wipers that are missing or inoperable
- ☐ Steering wheel that has a deficiency affecting the drivability of the vehicle
- ☐ Oil pressure, engine, and/or transmission temperatures that can not be monitored or verified
- ☐ Speedometer that is inoperable
- ☐ Air gauge or audio low air warning device that has failed or is inoperable when air pressure < 60 psi (vehicles with air brakes)
- ☐ Door latches that are defective
- ☐ Defrosters that are inoperable
- ☐ Foot throttle that is inoperable



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Chassis, Axles, Steering and Suspension Systems, Driveline, Wheels, and Tires**

The following defects and deficiencies of the chassis, axles, steering and suspension systems, driveline, wheels, and tires reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Tires that have cuts in the sidewall that penetrate to the cord
- ☐ Tires that have a tread depth of 4 /32 in. (3.2 mm) or less on any steering axle or 2 /32 in. (1.6 mm) or less on any non-steering axle at any two adjacent major tread grooves anywhere on the tire
- ☐ Any tire that is flat or has a detectable or audible leak
- ☐ On dual wheel tires: tires that are touching sidewall to sidewall when properly inflated
- ☐ Suspension components that are defective
- ☐ Wheel studs missing or loose wheel lugs
- ☐ Wheels that are cracked, bent, and/or broken that affect drivability
- ☐ Axle flanges that have Class 3 leakage
- ☐ An axle with a hub seal that has any Class 3 leakage or an empty reservoir
- ☐ Steering components that are defective affecting the vehicle handling
- ☐ A steering component that has Class 3 leakage
- ☐ Driveline components that are defective



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Engine Systems and Exhaust**

The following defects and deficiencies of the engine systems reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Air filter restriction indicator that shows maximum restriction after resetting
- ☐ Engine system that has significant leakage of oil
- ☐ Engine that is overheating
- ☐ Oil that contains coolant
- ☐ Oil that is diluted with fuel
- ☐ A fuel system component that has Class 2 leakage of fuel
- ☐ Fuel tank, mountings, or straps that are defective
- ☐ Fuel cap is missing or does not seal to prevent spillage
- ☐ Stop-engine light that fails to turn off after engine is started
- ☐ Exhaust components are broken or hanging
- ☐ Exhaust components are that leaking causing exhaust fumes to enter the cab or patient compartment

#### **Engine Cooling System**

The following defects and deficiencies of the engine cooling system reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Cooling system component that has Class 3 leakage
- ☐ Coolant that contains oil
- ☐ Radiator that is loose
- ☐ Cooling fan that is loose or cracked



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Transmission and Clutch**

The following defects and deficiencies of the transmission and clutch reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Automatic transmission that overheats
- ☐ Automatic transmission that has a "Do not shift" light on
- ☐ Transmission fluid that contains engine coolant
- ☐ Transmission components that have Class 3 leakage of transmission oil

#### **Low-Voltage, Line Voltage Electrical Systems, and Warning Devices**

The following defects and deficiencies of the low voltage electrical system and the line voltage electrical system reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Charging system that fails to maintain 12-volts
- ☐ Grounding and bonding of the line voltage electrical system that is defective
- ☐ Insufficient DOT lighting to clearly mark the vehicle
- ☐ Insufficient warning lighting to clearly indicate emergency response
- ☐ Turn-signal is inoperable
- ☐ There is not any operable audible DOT warning devices (at least either the electric horn or the air horn, if so equipped, must be operable)
- ☐ There are not any operable audible emergency warning devices (at least the electronic siren, or the mechanical siren, if so equipped, must be operable)



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

## **Braking Systems**

### **Air Brake Systems**

The following defects and deficiencies of the air brake system reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service. Use the prescribed test procedure for a commercial driver's license to assist with determining out of service condition.

- ☐ Service brakes that have an air pressure drop of more than 2 psi (13.8 kPa) in 1 minute for single fire apparatus or more than 3 psi (20.7 kPa) in 1 minute for combination fire apparatus, with the engine stopped and the service brakes released
- ☐ Leak-down rate (time) of the applied side of the air brake that is more than 3 psi (20.7 kPa) in 1 minute for single fire apparatus or more than 4 psi (27.6 kPa) in 1 minute for combination fire apparatus, with the engine stopped and the service brakes applied
- ☐ Braking system components that are defective
- ☐ Braking operation that is ineffective
- ☐ Parking brake operation that is ineffective
- ☐ Air compressor that fails to build air pressure. The time to build air pressure from 50 psi to 90 psi should not exceed 3 minutes
- ☐ Air compressor that fails to maintain 80–90 psi (552–621kPa) pressure in the system with the service brakes applied and the engine at idle, or air compressor that fails to fill the air system to the air compressor governor cutout pressure with the service and parking brakes released
  - The cut-out pressure should not exceed 135 psi
  - The cut-in pressure should not be less than 80 psi
- ☐ Antilock braking system (ABS) warning indicator that is activated upon checking chassis operator's manual to determine the indicator light's meaning. (The warning indicator generally indicates that ABS is inoperable and the vehicle should be driven as such.)



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Hydraulic Brake Systems**

The following defects and deficiencies of the hydraulic brake system reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Brake system components that have Class 2 leakage of brake fluid
- ☐ Friction surfaces, brake shoes, or disc brake pads that have grease or oil on them
- ☐ Braking operation that is ineffective
- ☐ Parking brake operation that is ineffective
- ☐ Brake warning light that is activated or brake pedal that falls away or drifts toward the flooring when brake pressure is applied
- ☐ Antilock braking system (ABS) warning indicator that is activated upon checking chassis operator's manual to determine the indicator light's meaning. (The warning indicator generally indicates that ABS is inoperable and the vehicle should be driven as such.)

#### **Fire Pump System**

The following defects and deficiencies of the fire pump system reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Pump that will not engage
- ☐ Pressure control system that is not operational
- ☐ Pump transmission components that have Class 3 leakage of fluid
- ☐ Pump panel throttle that is defective
- ☐ Master gauges inoperable
- ☐ Discharge relief valve not operable
- ☐ Primer motor not operable
- ☐ Tank-to-pump valve leaks
- ☐ Water leak in continuous stream



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Aerial Device Systems**

The following defects and deficiencies of the aerial device and its systems reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service:

- ☐ Power takeoff (PTO) that will not engage
- ☐ Stabilizer system that is defective
- ☐ Aerial device that is defective
- ☐ Hydraulic system components that are defective
- ☐ Cable sheaves that are defective
- ☐ Cables that are broken or frayed
- ☐ Aerial device that is structurally deformed
- ☐ Torque box structure or fasteners that are defective
- ☐ Turntable fasteners that are defective or missing
- ☐ Class 3 leakage from aerial components



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Inspections**

All inspections shall be conducted in accordance with the manufacturer's recommended procedures.

It shall be the responsibility of the authority having jurisdiction to develop and implement a schedule of service and maintenance for the fire apparatus, systems, and components described in this document, based on manufacturer's recommendations, local experience, and operating conditions.

Inspections shall be performed at least as frequently as the manufacturer's recommended intervals and when the fire apparatus or any component is suspected or reported to have defects or deficiencies.

All defects or deficiencies found during an inspection shall be repaired or corrected by a qualified person.

It shall be the responsibility of the authority having jurisdiction to develop written criteria for when the apparatus is to be taken out of service. The presence of defects and deficiencies that reduce the operational safety and performance of the apparatus below the level established in the 49 CFR, part 390, "Federal Motor Carrier Safety Regulations"; applicable federal, state, and local regulations; applicable nationally recognized standards; manufacturers' recommendations; and guidelines established by the fire department or its designated service and maintenance organization shall be considered when placing the apparatus out of service.

The apparatus shall be returned to service only after defects and deficiencies have been corrected.



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

#### **Definitions**

**Adjust.** To maintain or regulate, within prescribed limits, by setting the operating characteristics to specified parameters.

**Alignment.** To adjust components to bring about optimum or desired performance.

**Authority Having Jurisdiction.** The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

**Calibrate.** To correlate the reading of an instrument or system of measurement with a standard.

**Collector Rings.** A means of transmitting electrical power to the aerial device turntable from the main power supply; usually, concentric rings made of brass that are contacted by brushes to make the transfer to the specific electrical functions.

**Component.** A constituent part of a mechanical or electrical device.

**Defect.** A discontinuity in a part or a failure to function that interferes with the service or reliability for which the part was intended.

**Defective.** Having a defect, or faulty, namely loose, broken, or missing.

**Deformation.** Abnormal wear, defects, cracks or fractures, warpage, and deviations from the original condition that would affect safe and correct operation.

**Documentation.** The process of gathering, classifying, and storing information.

**Failure.** A cessation of proper functioning or performance.

**Fire Apparatus.** A vehicle used for fire suppression or support by a fire department, fire brigade, or other agency responsible for fire protection.

**Combination Fire Apparatus.** A vehicle consisting of a pulling tractor and trailer.

**Single Fire Apparatus.** A vehicle on a single chassis frame.

**Frame.** The basic structural system that transfers the weight of the fire apparatus to the suspension system.

**Inspect.** To determine the condition or operation of a component(s) by comparing its physical, mechanical, and/or electrical characteristics with established standards, recommendations, and requirements through examination by sight, sound, or feel.

**Interlock.** A device or arrangement by means of which the functioning of one part is controlled by the functioning of another.



## MONTGOMERY COUNTY FIRE AND RESCUE SERVICE

### Operator's Guide to Fire Apparatus Out of Service Criteria

**Ironing.** Damage in the form of wear or indentations caused to the bottom of the aerial device base rail material by misalignment or malfunction of the rollers.

**Leakage.** The escape of a fluid from its intended containment, generally at a connection. The three classes of leakage are defined.

**Leakage, Class 1.** Seepage of fluid, as indicated by wetness or discoloration, not great enough to form drops.

**Leakage, Class 2.** Leakage of fluid great enough to form drops, but not enough to cause drops to fall from the item being inspected.

**Leakage, Class 3.** Leakage of fluid great enough to cause drops to fall from the item being inspected.

**Maintenance.** The act of servicing a fire apparatus or a component within the time frame prescribed by the authority having jurisdiction, based on manufacturer's recommendations, local experience, and operating conditions in order to keep the vehicle and its components in proper operating condition.

**Preventive Maintenance.** The act or work of keeping something in proper condition by performing necessary preventive actions, in a routine manner, to prevent failure or breakdown.

**Manufacturer's Recommendation (Specification).** Any requirement or suggestion a fire apparatus builder or component producer makes in regard to care and maintenance of its product(s).

**Modification.** An alteration or adjustment to any component that is a deviation from the original specifications or design of the fire apparatus.

**Operator Alert Device.** Any device, whether visual, audible, or both, installed in the driving compartment or at an operator's panel, to alert the operator to either a pending failure, an occurring failure, or a situation that requires his or her immediate attention.

**Optical Source.** Any single, independently mounted, light-emitting component in a lighting system.

**Overhaul.** To inspect, identify deficiencies, and make necessary repairs to return a component to operational condition.

**Power Train.** The parts of a fire apparatus that transmit power from the engine to the wheels, including the transmission, split shaft power takeoff, midship pump transmission, drive shaft(s), clutch, differential(s), and axles.

**Powered Equipment Rack.** A power-operated device that is intended to provide storage of hard suction hoses, ground ladders, or other equipment, generally in a location above apparatus compartments.

**Proper.** As recommended by the manufacturer.



## **MONTGOMERY COUNTY FIRE AND RESCUE SERVICE**

### **Operator's Guide to Fire Apparatus Out of Service Criteria**

**Qualified Person.** A person who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has demonstrated the ability to deal with problems relating to a particular subject matter, work, or project.

**Repair.** To restore to sound condition after failure or damage.

**Replace.** To remove an unserviceable item and install a serviceable counterpart in its place.

**Severe Service.** Those conditions that apply to the rigorous, harsh, and unique applications of fire apparatus, including but not limited to local operating and driving conditions, frequency of use, and manufacturer's severe service (duty) parameters.

**Shall.** Indicates a mandatory requirement.

**Should.** Indicates a recommendation or that which is advised but not required.

**Steering Axle.** Any axle designed such that the wheels have the ability to turn the vehicle.

**Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

**Operational Test.** A test to determine the operational readiness of a component on a fire apparatus by observing the actual operation of the component.



**MONTGOMERY COUNTY FIRE AND RESCUE SERVICE  
DRIVER/OPERATOR TRAINING PROGRAM**

## Practical Application Guide Sheet

### Emergency Vehicle: Pre-Trip Inspection

**Candidate Name:** \_\_\_\_\_

**Candidate Performance Competency:** The candidate will explain the purpose of and perform a pre-trip inspection on the vehicle. The Pre-Trip Inspection will be completed in accord with Maryland Commercial Motor Vehicle Guidelines.

Component	Value	Score
<b>VEHICLE OVERVIEW - 5 points</b>		
1. Park the vehicle on a stable and reasonably level surface. Place a wheel chock to the front and rear of the rear tire.	1	
2. Body components and lights intact, not missing, or damaged.	1	
3. Look down each side of the body to identify any leaning that may indicate weak or broken suspension components.	1	
4. Vehicle Exterior    ✓ Mirrors secure, clean, and free of defects ✓ Compartment and cab doors latch ✓ Exterior mounted equipment secure	1	
5. Look beneath the vehicle for obvious leaks or components hanging loose	1	
<b>MOTOR COMPARTMENT – 23 points</b>		
6. Raise hood checking the springs and safety cables; or Tilt cab ensuring piston safety locks engage. Candidate must ensure loose items are secure inside the cab before tilting and overhead is clear. (CFP)	2	
7. Check the following fluids for adequate levels and quality as indicated:		
a) Motor Oil ✓ level should be above the "add" mark; fill as needed ✓ foamy there may be water in the oil ✓ diesel fuel odor may indicate internal motor failure	2	
b) Coolant ✓ check level in sight glass or translucent area on reservoir ✓ only fill with proper mixture as provided by CMF	2	
c) Power Steering Fluid ✓ level should be above the "low" or "add" mark	2	
d) Brake Fluid (pre-2007 and post-2015 ambulances) ✓ Check level in both chambers on master cylinder; preferred to view through translucent chambers over removing caps ✓ Observe any signs of leaks	2	

Component		Value	Score		
8. Alternator	<ul style="list-style-type: none"><li>✓ Securely mounted</li><li>✓ No loose connections</li></ul>	1			
9. Fan	<ul style="list-style-type: none"><li>✓ All blades present with no damage</li><li>✓ Shroud intact and free of debris</li></ul>	1			
10. Radiator	<ul style="list-style-type: none"><li>✓ Securely mounted with cap securely in place</li><li>✓ Free of leaks, major debris, and significant damage</li></ul>	1			
11. Water Pump	<ul style="list-style-type: none"><li>✓ Securely mounted</li><li>✓ Free of leaks</li><li>✓ Candidate will note if the pump is belt or gear driven</li></ul>	2			
12. Air Compressor	<ul style="list-style-type: none"><li>✓ Securely mounted</li><li>✓ Free of leaks</li><li>✓ Candidate will note if the pump is belt or gear driven</li></ul>	2			
13. Power Steering Pump	<ul style="list-style-type: none"><li>✓ Securely mounted</li><li>✓ Free of leaks</li><li>✓ Candidate will note if the pump is belt or gear driven</li></ul>	2			
14. Hoses	<ul style="list-style-type: none"><li>✓ Free of leaks, cuts, cracks, and bulges</li></ul>	1			
15. Belts	<ul style="list-style-type: none"><li>✓ Free of cuts, cracks, and fraying</li><li>✓ Properly tensioned - less than 3/4" deflection</li></ul>	1			
16. Wiring	<ul style="list-style-type: none"><li>✓ Securely fastened as appropriate</li><li>✓ Free of damage or deterioration</li><li>✓ No signs of overheating or melted insulation</li><li>✓ Insulation intact</li><li>✓ Terminals secure, free of corrosion</li></ul>	1			
17. Batteries	<ul style="list-style-type: none"><li>✓ Free of leaks and corrosion</li><li>✓ Terminals and connections secure</li><li>✓ Batteries secured within box</li></ul>	1			
STEERING SYSTEM – 12 points					
18. Steering system components will be evaluated by the following criteria: No loose or broken components. No welded repairs. No inappropriate movement or slack of any component.					
a) Steering shaft to steering box	1		g) drag link	1	
b) Steering box securely mounted	1		h) steering arm	1	
c) Steering box not leaking	1		i) castle nut & locking pin	1	
d) Output shaft properly aligned	1		j) driver's side lower control arm	1	
e) Pitman Arm	1		k) tie rod	1	
f) Castle nut & locking pin	1		l) officer's side lower control arm	1	
SUSPENSION SYSTEM – 4 points					
19. Spring Mounts	<ul style="list-style-type: none"><li>✓ must be secure to the frame</li><li>✓ free from cracks or damage</li></ul>	1			
20. Springs	<ul style="list-style-type: none"><li>✓ Stack must aligned</li><li>✓ Free of cracks or obvious deformity</li><li>✓ No missing parts or spring leaves</li></ul>	1			

Component		Value	Score
21. U-bolts	<ul style="list-style-type: none"> <li>✓ Must not be missing</li> <li>✓ Free of cracks or deformities</li> <li>✓ Locking nuts must be present</li> </ul>	1	
22. Air Suspension	<ul style="list-style-type: none"> <li>✓ Inflates equally</li> <li>✓ Shock mounts free of cracks or deformity</li> <li>✓ No obvious leaks</li> </ul>	1	
<b>BRAKE SYSTEM – 14 points</b>			
23. Candidate will identify the type of brake system; air or hydraulic.		2	
24. Chambers	✓ No obvious damage or defects	1	
25. Pushrods	<ul style="list-style-type: none"> <li>✓ Must not be overextended</li> <li>✓ Clevis pins must be in place</li> </ul>	1	
26. Anti-Lock Wires	<ul style="list-style-type: none"> <li>✓ Free of obvious damage</li> <li>✓ Must be secured</li> </ul>	1	
27. Fluid or Air Lines	<ul style="list-style-type: none"> <li>✓ Free of cracks, cuts, leaks, or deformity</li> <li>✓ Securely fastened to chambers</li> </ul>	1	
<b>Front</b>		<b>Rear</b>	
1	Disc or Drum	1	
1	No cracks or missing pieces	1	
1	Heat checks on < ½ surface	1	
1	thickness > 1/8" pads or 1/4" shoes	1	
<b>WHEELS &amp; TIRES – 16 points</b>			
28. All tires must be free of damage that exposes the cords and bulges that are indicative of tire core separation.			
<b>Front</b>		<b>Rear</b>	
Condition	1	Condition	1
Inflation	1	Inflation	1
Depth > 4/32"	1	Depth > 2/32"	1
Tires match	1	Dual tires not touching	1
Bead not exposed	1	Bead not exposed	1
Wheels not cracked or welded	1	Wheels not cracked or welded	1
Studs and lugs tight	1	Studs and lugs tight	1
Hub oil present & clean	1	Mud flaps present, not rubbing tires	1
<b>UNDERCARRIAGE – 4 points</b>			
29. Frame rails and cross members	<ul style="list-style-type: none"> <li>✓ No bends, sags, or cracks in rails or cross members</li> <li>✓ No illegal welded repairs</li> <li>✓ No missing, broken, or loose bolts</li> </ul>	1	

Component		Value	Score
30. Cab, motor, and body mounts	<ul style="list-style-type: none"> <li>✓ No obvious damage or defects</li> <li>✓ No loose or broken connections</li> </ul>	1	
31. Exhaust System	<ul style="list-style-type: none"> <li>✓ No leaks</li> <li>✓ All hangers are secure</li> <li>✓ No significant damage or defects</li> </ul>	1	
32. Automatic Chains	<ul style="list-style-type: none"> <li>✓ No missing components</li> <li>✓ Securely mounted</li> <li>✓ Friction rubber on chain wheel intact</li> </ul>	1	
<b>DRIVE LINE – 2 points</b>			
33. Drive shaft	<ul style="list-style-type: none"> <li>✓ No obvious damage or defects</li> </ul>	1	
34. U-joint and carrier bearing	<ul style="list-style-type: none"> <li>✓ No missing components or obvious defects</li> <li>✓ Bearing secure</li> </ul>	1	
<b>FUEL TANK – 3 points</b>			
35. Mount	<ul style="list-style-type: none"> <li>✓ Gaskets and straps in place and secure</li> <li>✓ No signs of leaks</li> </ul>	1	
36. Fuel cap	<ul style="list-style-type: none"> <li>✓ Gasket in place</li> </ul>	1	
37. Fuel level	<ul style="list-style-type: none"> <li>✓ Visually compare actual level to gauge reading</li> </ul>	1	
<b>IN CAB – 10 points</b>			
38. Housekeeping	<ul style="list-style-type: none"> <li>✓ Trash and debris removed</li> <li>✓ No loose items on the floor or dashboard</li> <li>✓ Windows reasonably clean</li> </ul>	1	
39. Defroster	<ul style="list-style-type: none"> <li>✓ Vents clear of blockages</li> <li>✓ Blower and thermostat function</li> </ul>	1	
40. Seats & Seatbelts	<ul style="list-style-type: none"> <li>✓ Seat secured to the floor with no missing fasteners or components</li> <li>✓ Seat adjusts and locks into position</li> <li>✓ Seatbelt free of cuts, holes, fraying</li> <li>✓ Seatbelt buckles and unbuckles freely</li> <li>✓ Seatbelt retracts and extends freely</li> </ul>	2	
41. Windshield	<ul style="list-style-type: none"> <li>✓ Free of defects that distort vision</li> <li>✓ Free of cracks</li> <li>✓ Wipers function; blades intact and make good contact with glass</li> </ul>	1	
42. Steering Wheel	<ul style="list-style-type: none"> <li>✓ No defects or damage</li> <li>✓ No more than 10% free play</li> <li>✓ Horn functions</li> </ul>	1	
43. Running Lights	<ul style="list-style-type: none"> <li>✓ Headlights, taillights, turn signals, marker lights, hazard signals all functional</li> <li>✓ Light lenses not faded and proper color</li> </ul>	1	
44. Warning Lights	<ul style="list-style-type: none"> <li>✓ All lights functioning</li> <li>✓ Lenses in place with no damage</li> </ul>	1	
45. Reverse Signals	<ul style="list-style-type: none"> <li>✓ Audible alarm functioning at proper volume</li> <li>✓ Reverse lights functioning</li> <li>✓ Camera functioning</li> </ul>	1	
46. Safety Equipment	<ul style="list-style-type: none"> <li>✓ Wheel chock(s) present</li> <li>✓ High visibility vests for each riding position</li> <li>✓ Six road flares or three triangles present</li> <li>✓ Fire extinguisher with a rating of greater than 5B:C</li> </ul>	1	

Component		Value	Score
<b>MOTOR RUNNING – 7 points</b>			
47. Gauges	<ul style="list-style-type: none"> <li>✓ Gauges reading within normal ranges with motor running</li> <li>✓ Gauges illuminated and legible</li> </ul>	1	
48. Transmission Fluid	<ul style="list-style-type: none"> <li>✓ checked with motor running</li> <li>✓ transmission in neutral and warmed to 140-160°F</li> <li>✓ fluid should be reddish color; not brown</li> <li>✓ brown fluid that smells burnt signals a potential problem</li> </ul>	2	
49. Listen for abnormal sounds from the motor, belts, mechanical linkages, or other components.		2	
50. Note abnormal smells such as coolant, fuel, or electrical overheating		2	
<b>Total Points</b>		100	

## Critical Fail Points

*Failure to successfully perform any of the following components will result in an automatic failure of this evolution regardless of total score.*

- a) Failing to engage the safety mechanism on a tilt cab prior to starting an inspection
- b) Failure to conduct a thorough examination of any of the following systems as a whole: brakes, steering, tires, and suspension

**Evaluator: Initial beside the final outcome of the exam below.**

\_\_\_\_ PASS    \_\_\_\_ FAIL – Overall Points (<70%)    \_\_\_\_ FAIL – Critical Fail Point

\_\_\_\_\_  
**Evaluator Name**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Evaluator Signature**





**MONTGOMERY COUNTY FIRE AND RESCUE SERVICE  
DRIVER/OPERATOR TRAINING PROGRAM**

## Practical Application Guide Sheet

### Emergency Vehicle: Pre-Trip Air Brake Check

**Candidate Name:** \_\_\_\_\_

**Candidate Performance Competency:** Candidate will conduct a pre-trip check of the vehicle air brake system per MVA guidelines in the order shown (COMAR 11.22.02.06).

Task	Value	Score
1. Place wheel chocks on both sides of a rear tire.	8	
2. Turn on the vehicle battery and ignition switch. Verify gauges and air system warning signals are functioning.	6	
3. Verify the parking brake is applied. ✓ air protection valve (APV) is out ✓ applied parking brake implies that no air is charging the brake chamber	6	
4. Release the parking brake and allow the air tanks to settle. ✓ APV is in	6	
5. Observe the air gauges for 1 minute for air loss exceeding guidelines. ✓ Straight Truck: <3psi loss in 60 seconds ✓ Tractor Trailer: <4psi loss in 60 seconds	8	
6. Apply steady pressure to the brake pedal and let the air tanks settle. Continue to hold pressure for 60 seconds.	6	
7. Continue to hold steady pressure for 60 seconds and observe the air gauges for air loss exceeding guidelines. ✓ Straight Truck: <3psi loss in 60 seconds ✓ Tractor Trailer: <4psi loss in 60 seconds	6	
8. Fan the brake pedal to bleed air from the system and observe the audible and visible low-air alarms for accurate activation. ✓ Air level range of 60-90psi	8	
9. Fan the brake pedal to continue bleeding air from the system and observe the APV automatically engages the parking brake. ✓ Air level range of 20-40psi ✓ APV is out	8	
10. Candidate will note that a failure of the APV to automatically activate will result in the vehicle failing the brake test	6	
11. Candidate must stop fanning the brake pedal once the APV activates. ✓ Damage to the brakes may occur if the pedal is fanned while the parking brakes are engaged	6	

Task	Value	Score
<b>12. Start the motor and increase idle to 1200rpm. Observe the air pressure gauges to ensure pressure is building effectively.</b> ✓ Pressure must rise from 50 psi pressure to 90 psi <3 minutes at 1200rpm. ✓ air pressure must not build past 135psi	8	
<b>13. Ready the apparatus for service.</b> ✓ Verify all gauges have reached working pressures ✓ shut down motor ✓ remove wheel chocks as appropriate	4	
<b>COLA Acronym</b>		
<i>Candidate will describe the acronym COLA as it applies to air brake systems.</i>		
<b>14. C: cut-in pressure</b> ✓ Compressors should engage to replenish air systems at approximately 100psi ✓ Compressors that do not engage prior to 95psi merit a defect report ✓ Compressors that do not engage prior to 80psi meet OOS criteria	2	
<b>15. O: cut-out pressure</b> ✓ Compressors should disengage once air systems reach 120 to 135psi ✓ Compressors that do not disengage prior to 135psi meet OOS criteria	2	
<b>16. L: low pressure warning</b> ✓ Audible and visible warnings must activate at 60 to 90psi ✓ Warnings that activate below 60psi merit a defect report	2	
<b>17. A: air leakage</b> ✓ Must be less than 3psi/minute for straight trucks ✓ Must be less than 4psi/minute for tractor trailer trucks	2	
<b>NFPA 1911 Chapter 12 – Air Brake System “Quick Build-up”</b>		
<i>Candidate will describe the requirements of NFPA 1911 Chapter 12.</i>		
<b>18. Apparatus air brake system drained to 0 psi.</b>	2	
<b>19. Start the motor and increase idle to enhance air compressor output.</b>	2	
<b>20. Brake system will become serviceable within 60 seconds.</b> ✓ Sufficient pressure exists to move the apparatus without brake drag; and ✓ is able to come to a full stop using service brakes.	2	
<b>Total Points</b>	100	

## **Critical Fail Points**

*Failure to successfully perform any of the following components will result in an automatic failure of this evolution regardless of total score.*

a) Failure to complete any of Steps 1 through 13

b) Failure to complete steps 1 through 13 in order

**Evaluator: Initial beside the final outcome of the exam below.**

\_\_\_\_ PASS    \_\_\_\_ FAIL – Overall Points    \_\_\_\_ FAIL – Critical Failure Point

\_\_\_\_\_  
**Evaluator Name**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Evaluator Signature**



### EMERGENCY VEHICLE OPERATOR

## CLASS "B"

Module 3

Physical Forces  
Skid Avoidance & Management  
Rollover Prevention



### OBJECTIVES

- To identify common conditions that lead to loss of vehicle control.
- To identify common driver errors that lead to loss of vehicle control.
- Discuss vehicle features and systems to assist with vehicle control.
- Differentiate between passenger vehicles and emergency vehicles
- Familiarization with actions to take to maintain or regain control



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Module 3

### MOTIVATION

Why is this necessary?

- ✓ Service does not stop in bad weather
- ✓ Emergency vehicle dynamics are different than a passenger vehicle
- ✓ High speed – slow motion



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Module 3

### SKID AVOIDANCE



The ability to maintain control of the vehicle utilizing.... defensive driving skills and vehicle controls while..... accounting for existing road and traffic conditions.



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Module 3

### CLASS B VS. PASSENGER VEHICLES

- Heavy Apparatus vs. Passenger Car
  - Weight
  - Center of gravity
  - Steering system
- Heavy Apparatus vs. Race car
  - Suspension
  - Tires



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Module 3

### ENERGY OF MOTION

- Kinetic energy is the force that keeps the vehicle moving

Kinetic Energy =  $\frac{1}{2}$  (weight of vehicle)(starting speed<sup>2</sup> – final speed<sup>2</sup>)

- Kinetic energy doubles as the weight doubles
- Kinetic energy quadruples as speed doubles
- Kinetic energy is dissipated as heat by the brakes during application of breaks



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Module 3

### FRICTION

- Friction – resistance to motion between two moving objects that touch.
- Frictional force opposes the motion of the vehicle
- Frictional force occurs between:
  - the tire and the road surface when wheel rotation is locked by brakes
  - the brake pad/shoe and the rotor or drum
- The ability of a vehicle to stop depends on the coefficient of friction between the contacting surfaces.

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Module 3

### FRICTION

- Maximum useable coefficient of friction occurs between the tire and road surface.
- The amount of energy that can be absorbed by the brakes depends upon
  - the coefficient of friction of the brake materials,
  - brake diameter,
  - brake surface area,
  - shoe geometry, and
  - the pressure used to actuate the brake.
- Stopping a vehicle suddenly means very high friction, resulting in high brake and tire temperature.

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Module 3

### VEHICLE BALANCE AND TRACTION

When the vehicle is in motion:

- Sudden steering, braking and/or acceleration change vehicle balance and traction dramatically
- Sudden loss of vehicle balance causes traction loss and traction loss compounds crash results

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Module 3

### TRACTION VS. VEHICLE MOVEMENT

- Stationary (static) – A stationary vehicle parked on a flat surface with brakes set has greatest resistance to movement. A stationary tire has more traction than a sliding tire.
- Rolling (controlled dynamic) – A rolling tire has more traction than a sliding tire, thus it is important to not lock the brakes when trying to steer or stop a vehicle
- Sliding (uncontrolled dynamic) – A rolling tire can transition into a sliding tire under a variety of circumstances. The circumstances may or may not be predictable or controllable by the driver. A sliding tire offers little ability to change the path or speed of a vehicle.

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Module 3

### TRACTION

- Tire condition is critical to maintaining traction
  - Tread depth
  - Inflation
- Only about 10% of the tire's surface is in contact with the road at any time



~40 square inches of area

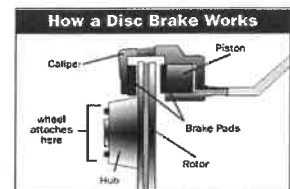
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Module 3

### VEHICLE SYSTEMS DISC BRAKES

- Generally shed debris, water, etc.
- Pads wear evenly
- Self cleaning
- Dissipate heat
- More easily inspected



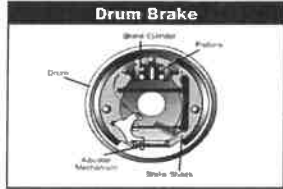
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Module 3

### VEHICLE SYSTEMS DRUM BRAKES

- Problem with debris, water, etc.
- Wears unevenly
- Builds up dirt
- Retain heat



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Module 3

### BRAKING SYSTEMS

- Electronic Braking Control Systems brake by wire
- Anti-lock Braking Systems (ABS)
- Secondary or Auxiliary Braking Systems
  - Driveline Retarder
  - Compression or Engine Brake
  - Exhaust Brake
  - Automatic Transmission Retarder

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Module 3

### AUXILIARY BRAKING SYSTEMS TELMA RETARDER

- Attached to the driveline
- Generates magnetic fields to counter the rotation of the drive shaft
- Found on most MCFR heavy apparatus



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Module 3

### AUXILIARY BRAKING SYSTEMS ENGINE BRAKE

- "Jake Brake"
- Alters the motor's exhaust valves to reduce power created in the cylinders
- Motor slows and translates to the drive train to slow the vehicle drive wheels
- New emissions systems eliminate classic sound



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Module 3

### AUXILIARY BRAKING SYSTEMS EXHAUST BRAKES

- Closes off the exhaust path
- Creates back pressure in the motor
- Reverses the natural flow of the motor to slow the motor
- Generate less slowing than an engine brake
- Usually found on smaller diesel vehicles
  - 2016 EMS Units

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Module 3

### AUXILIARY BRAKING SYSTEMS TRANSMISSION RETARDER

- FL80 chassis
- Vaned flywheel within transmission
- Oil directed into the flywheel to slow the transmission
- Heats up the transmission
  - Shift points become abrupt
  - Overheat condition can shut down the vehicle



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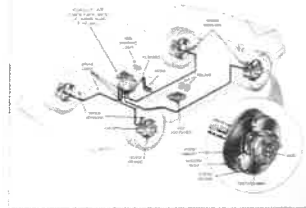
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Module 3

### ANTI-LOCK BRAKE SYSTEMS

- Electric control over hydraulic or air brakes
- Generates micro-pulses in the brake activation
  - Replaces pumping the brake pedal
- Senses wheel rotation speed to identify when lock-up is occurring

[ABS Video](#)



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Module 3

### BRAKE FADE

- Most of the heat created goes into the brake drum or disc during braking.
- Under severe use, brake drums may reach 600 degrees F.
- Coefficient of friction within the brake system is much lower at these high temperatures so that additional pedal pressure is required.
  - Repeated severe stops or after holding the brakes on a long down hill grade result in nearly no friction between the shoes/pads and the drum/rotor. This condition is called brake fade.
- Drum and disc expand during braking
  - Drum brakes: diameter of the drum increases with heat. The shoe no longer matches the drum and hence lining-to-drum contact surface becomes smaller, creating less friction area and even more heat.
  - Disc brakes: expansion of disc has little effect on braking because the pads apply braking force on the side of the disc and hence braking surface area remains constant.

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Module 3

### SKID CAUSES

- ☒ The need for speed
- ☒ Improper braking (including auxiliary brakes)
- ☒ Improper acceleration
- ☒ Improper steering
- ☒ Excessive weight transfer
- ☒ Poor roadway conditions

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Module 3

### SPEED

- Speed directly correlates to the kinetic energy of the vehicle
- Energy increases *exponentially* as speed increases
- Energy is neither created or destroyed – it just changes forms
- Greater energy has the following effects:
  - Brakes must convert the energy to heat – the more kinetic energy the more heat gets generated
  - Center of gravity shifts are more significant as momentum tries to keep the vehicle moving
  - Better tire adhesion to the road surface is required to work in conjunction with the brakes

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Module 3

### WHAT CAUSES A BRAKING SKID?

Brake pedal applied



Brake system creates friction to slow the rotation of the wheels



Friction between the tires and the road surface allow the tires to grab as the rotation of the wheel slows

*When the friction of the brake system is more than the friction of the wheels grabbing the road surface a skid occurs*

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Module 3

### VEHICLE BALANCE AND TRACTION BRAKING

- When brakes are applied:
  - Weight or center of mass transfers to the front of the vehicle
  - Causes a noticeable drop of the front of the vehicle and a rise in the rear
  - Occupants feel a forward movement
- Results in the front wheels needing more traction and the front brakes working harder than the rear



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Module 3

### BRAKE BALANCE

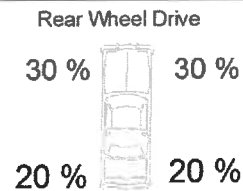
- The braking of a vehicle occurs at ground level
- Vehicle weight and kinetic energy of the vehicle act through center of gravity, which are above ground level
- This causes the vehicle to pitch forward as the brakes are applied.
  - some of the vehicle weight is effectively transferred from the rear wheels to the front wheels. Consequently, the front brakes must absorb more kinetic energy than the rear brakes.
- The front wheel static weight is normally 55% of the vehicle weight. Front brakes are designed to absorb this extra brake effort
- By design, the front brakes lock up slightly ahead of the rear brakes. This causes the car to go straight ahead and to not spin out.

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Module 3

### BRAKE BALANCE TYPICAL FIRE APPARATUS



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Module 3

### EFFECTIVE BRAKING

- Braking and Stopping
  - Hydraulic – Pump brake pedal
  - Air – Firmly and steadily press brake pedal, release if wheels lock
    - “threshold” braking
  - Anti-Lock Braking System (ABS) – Apply firmly and hold down for duration
  - Disc vs. Drum - Differences
- Auxiliary Braking Systems
  - Adjust use of retarders/engine brakes during inclement weather or when the road surfaces are slippery.
  - Using these systems could result in loss of control of the vehicle.
  - Manufacturer recommendations vary.

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Module 3

### ACCELERATION SKID

Accelerator pedal applied



Power train applies torque to rotate the wheels faster



Friction between the tires and the road surface allow the tires to grab as the rotation of the wheel increases

*When the torque applied to the wheels is more than the friction of the wheels grabbing the road surface a skid occurs*

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EVOC - Class B

Module 3

### ACCELERATION SKID VEHICLE BALANCE AND TRACTION

- When acceleration is applied:
  - Weight or center of mass transfers to the rear of the vehicle
  - Causes a noticeable rise to the front of the vehicle and a drop in the rear of the vehicle
  - Occupants feel a rearward movement
- Results in the rear wheels getting more traction
- Results in front wheels having less traction for steering



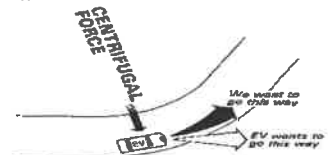
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Module 3

### STEERING SKID

- An object moving in a straight line wants to remain in a straight line
- Factors contributing to a steering skid:
  - Speed
  - Weight and weight transfer
  - Surface traction
  - Tire height, condition, inflation
  - Radius of the turn



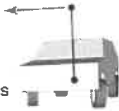
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Module 3

### STEERING SKID VEHICLE BALANCE AND TRACTION

- When steering is applied:
  - Weight or center of mass transfers to the front right or left of the vehicle
  - Causes a noticeable drop and tilt of the front of the vehicle and a rise and tilt of the rear of the vehicle
  - Occupants feel a movement forward to the corner of the vehicle
- Places the vehicle in an imbalanced position with one tire having more of the load
- Braking while steering further shifts the center of mass
- Best to gain and lose speed in a straight line where the tires share the load!



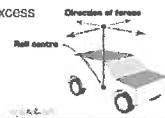
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Module 3

### EXCESSIVE WEIGHT TRANSFER

- Transfer occurs every time the vehicle accelerates, slows, or changes direction
- Amount of transfer is dependent upon weight, height of the center of gravity, and the rate of acceleration/deceleration
  - Which factor do you control?
- Effects of weight transfer
  - Too little weight and the rubber doesn't stick to the road
  - Too much weight causes it to stick too hard and creates excess heat
  - Damage to suspension
- Slope or grade of road surface
- Water tanks



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EVOG - Class B

Module 3

### EXCESSIVE WEIGHT TRANSFER WATER INFLUENCE

- Liquid movement creates force forward, rearward, and sideways
- Baffles dampen the effect forward and aft
- Actively changing center of gravity
- Tankers
  - Easy to roll over
  - Can turn over at posted speed limits
  - On & off ramps should be driven slower



3,000 gallons of H<sub>2</sub>O =  
24,000lbs of H<sub>2</sub>O

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Module 3

### EXCESSIVE WEIGHT TRANSFER AERIAL LADDERS

Aerial devices  
create a high center  
of gravity



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Module 3

### SURFACE CONDITIONS

- Friction must exist between the tire and the road for braking and steering to occur
- Anything that interferes with the contact area between the tire and the road surface can cause skidding
  - Rain – hydroplaning
  - Snow/Ice
  - Gravel, Sand, Dirt
  - Leaves
  - Rough surface
  - Road slope/grade



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Module 3

### SPECIFIC CONDITIONS

- "One tire in mud, other on roadway"
  - All power to wheel of least resistance
- Shocks/springs cause vehicle to ride level even if banked roadway
- If tire cannot get traction to go forward, it will go sideways
- Access ramps
  - Radius stays constant or tightens
  - Must back down
  - Cannot go in fast and come out faster

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EVOG - Class B

Module 3

### SURFACE CONDITIONS

Shaded areas – Shady parts of the road will remain icy or wet long after open areas

Bridges – When the temperature drops, bridges will freeze before the road will. Be especially careful when the temperature is close to 32 degrees Fahrenheit

Melting Ice – Slight melting will make ice wet. Wet ice is much more slippery than ice that is not wet.

Black Ice – Black ice is a thin layer that is clear enough that you can see the road underneath it. It makes the road look wet.

[Black Ice Video](#)

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EVOB - Class B

Module 3

### SURFACE CONDITIONS

Just After Rain Begins – Right after it starts to rain, the water mixes with oil left on the road by vehicles. This makes the road slippery. If the rain continues, it will wash the oil away.

Raining/Wet – Water collected on the road may cause tires to lose their contact with the road and have little or no traction and your vehicle may hydroplane.

Leaves & Debris – Following a storm or during the Fall leaves or other debris collect on the road. Leaves can be as slippery as ice.

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Module 3

### SURFACE CONDITIONS

Excessive Heat – Heat can soften the road surface or even cause buckling. The surface aggregate can peel away as a tire tries to grip.

Dirt/Gravel/Sand – Any loose material between the tire and a hard surface reduces traction. Frequently these conditions are combined with uneven surfaces.

Pitted or Potholed – vehicle suspension and tires may not adjust to the unequal surfaces and allow traction to be lost as the vehicle "bounces".

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Module 3

### DRIVING ERRORS

Vehicle begins to slide, driver panics

☒ Locks the Brakes

☒ Loses steering control

Driver responds by:

☒ Correcting steering too late

☒ Under correcting

☒ Using improper throttle control

☒ Combination of all above

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Module 3

### SIX DEADLY SKIDS

- All-wheel braking skid
- Front wheel braking skid
- Rear wheel braking skid
- Power skid
- Hydroplaning



[Front and Rear Wheel Skid Video](#)

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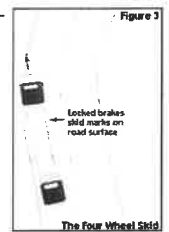
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Module 3

### SKIDS

#### ALL-WHEEL

- Often start as front or rear skids and turn into all-wheel
- No steering control
- Vehicle will travel in straight line until other forces or friction act upon it
  - If the car was going straight it will continue straight
  - If the car was going around a curve, the car will slide sideways in the path it had at the moment when traction was lost
- Front locks first



rev. 04/18

EVOB - Class B

Module 3

# MCFRS EVO Class B Course

## Module 3

### SKIDS ALL-WHEEL

- Regain Control
  - Must release brakes so wheels begin to roll again
  - Rolling friction vs. sliding friction
- Behavior/Performance
  - Vehicle slides straight ahead
  - Body in motion stays in motion
  - No steering ability

REV. 6/4/18

EVOC - Class B

Module 3

### SKIDS FRONT WHEELS

- Excess speed upon entry into a curve or while avoiding a hazard, or
- Braking sharply while turning to avoid a hazard
- Vehicle does not respond to steering
- Vehicle tracks in line with the rear wheels until the front wheels regain traction



The Front Wheel Skid

REV. 6/4/18

EVOC - Class B

Module 3

### SKIDS FRONT WHEELS

- Behavior/Performance
  - At 27mph front lock – rear rotates, one more time
  - At 65 mph front lock – rear rotates nine more times
  - Cause of vehicle turning sideways
  - Car should slide straight ahead
- Regaining Control
  - Decelerate to recover steering control of vehicle
  - Keep steering inputs to a minimum until tires regain traction

REV. 6/4/18

EVOC - Class B

Module 3

### SKIDS REAR WHEELS

- Improper throttle control
- Excessive weight transfer
- Rough or "jerky" steering
- Improper brake adjustment
- Parking or Emergency brake engaged
- Transmission – low gear
- Auxiliary braking systems engaging on slippery surfaces



The Rear Wheel Skid

REV. 6/4/18

EVOC - Class B

Module 3

### SKIDS REAR WHEELS

- Turn steering in direction of skid
  - Amount of steering required to correct for slide, must be equal to the degree of slide
- Once vehicle swings out of line more than 25 degrees, steering correction will not be effective
- Driver fails to respond to the slide properly, either in timing or in the degree of correction, the vehicle will continue to slide out of control
  - When correction and the driver steers more than the degree of the slide (over correct), the primary slide will stop.
  - Vehicle will experience a severe weight transfer. Will induce a secondary slide in the opposite direction.

REV. 6/4/18

EVOC - Class B

Module 3

### SKIDS POWER

- Application of too much power for the road conditions.
- Accelerating too fast around a curve
  - Exceeding the critical speed of a curve
- Excessive power causes driving wheels to break traction
- "Fishtailing" is a characteristic
- Regaining Control
  - Reduce acceleration until the car stabilizes
  - Counter steer as needed

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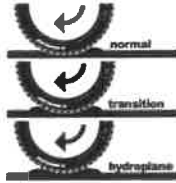
Module 3

### SKIDS HYDROPLANING

- Occurs due to water or slush build-up on the road surface
- Lifts the vehicle off the road surface
- Speed is too great for the tire tread to shed the water on the road surface

[Hydroplaning Description Video](#)

[Hydroplaning Video](#)



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EVOC - Class B

Module 3

### HYDROPLANING

- Partial Hydroplaning - counter steering, light application of brakes
- Total Hydroplaning - release accelerator and ride out the skid
  - Front wheels are riding on water, making track for rear wheels
  - Vehicle reacts the same as rear wheel skid.
- Counter-steer to keep the rear from swinging around
- Rolling tires eventually shed the water and regain traction
  - Avoid locking up the brakes or steering sharply

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Module 3

### ROLLOVER

Rollovers are almost always preceded by one or more of the following

- Skidding
- One or more tires leaving the paved or improved road surface
- Collision with another vehicle or object
- Mechanical failure



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Module 3

### ROLLOVER UNCONTROLLABLE FACTORS

- Vehicle specifications
  - Height
  - Weight and weight distribution
  - Width and wheelbase
  - Center of gravity
- Vehicle suspension and tires
- Road surface and configuration
  - Soft shoulders
  - Road surface slope
- Weather

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Module 3

### ROLLOVER CONTROLLABLE FACTORS

- Speed & Steering
- Driver attentiveness
- Vehicle condition
- Improper recovery/panic
  - Over-steering
  - Uncontrolled braking or accelerating
- Water tank levels



VFIS "Rollover Prevention" DVD

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EVOC - Class B

Module 3

### ROLLOVER ACTIONS

- When you sense your vehicle is about to overturn it may be too late to recover
- Stop accelerating
- Start braking gently - avoid additional weight transfer
- Both hands on the wheel at 9 and 3
- If your tires leave the paved surface:
  - Do not jerk the steering wheel to attempt to correct
  - Allow the vehicle to slow down
  - Re-enter the roadway one tire at a time - gradual merge

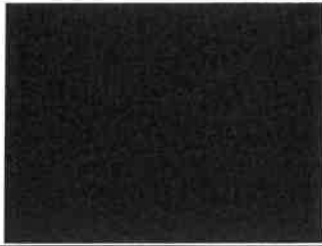
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Module 3

### ROLLOVER

- Raleigh, NC
- July 10, 2009
- Going on a "box"
- Response started while "on the air"



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EVOB - Class B

Module 3

### OTHER VEHICLE SYSTEMS

- **Automatic Traction Control (ATC) - video**
  - Applies the service brake to a spinning wheel so torque can be transferred through the differential to the wheel that has traction.
  - If both sets of drive axle wheels are spinning this system reduces engine torque until traction is sensed.
- **Roll Stability Control (RSC) - video**
  - Integral to the anti-lock braking system
  - Becomes active when the vehicle senses lateral acceleration that exceeds acceptable thresholds.
  - Works in stages by reducing engine torque, engaging the engine brake or retarder, and then applying the service brakes until lateral acceleration falls below thresholds.
- **Electronic Stability Control (ESC) - video**
  - Stabilizes the vehicle during cornering by detecting loss of steering control
  - Applies brakes to individual wheels and may reduce engine power until steering control is regained.

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EVOB - Class B

Module 3

### SUMMARY

- Heavy apparatus does not handle like a passenger vehicle
- Forces associated with heavy apparatus are far greater than passenger vehicles
- Drive in a manner that limits the reaction forces on the vehicle due to stopping and turning
- Once a heavy vehicle starts to skid it will tend to remain in a skid
- When you skid, you are OUT OF CONTROL

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EVOB - Class B

Module 3

### HOMEWORK

For next night session, review Case Study #1 and be prepared to discuss.

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EVOB - Class B

Module 3

# Fire engine slides off icy Fairfax road

POSTED 9:14 AM, DECEMBER 17, 2016, BY [SCOTT WISE](#)

*This is an archived article and the information in the article may be outdated. Please look at the time stamp on the story to see when it was last updated.*



FAIRFAX COUNTY, Va. — No firefighters were hurt when a Fairfax County Fire And Rescue Department fire engine slid off an icy road early Saturday morning.

This morning at approximately 5:25 a.m., a Fairfax County Fire And Rescue Department fire engine was involved in a crash at Route 50 and I-66 East in the Fair Oaks section of Fairfax County.

The engine, from Fire Station 21, Fair Oaks, was responding to a call when the crash occurred.

There were no reported injuries. Icy road conditions were a contributing factor in the crash.

An additional unit was dispatched to the original call.

The Fairfax County Fire and Rescue Department urges drivers to stay off the roads until treatments can be applied and temperatures rise.

Road conditions continue to be icy and hazardous.

# Fairfax County, VA Truck 411 overturns with minor injuries to 4 firefighters

Aug 12, 2014

An accident involving a Fairfax County fire truck has knocked out power to homes in the Alexandria section of the county early Tuesday.

Fairfax County fire engine 411 and truck 411 were responding to an emergency call near Beacon Hill Road and Anthony Street at approximately 4:30 a.m. when truck 411 was involved in an accident, according to Fairfax County Fire Department Public Information Officer Capt. Bill Moreland.

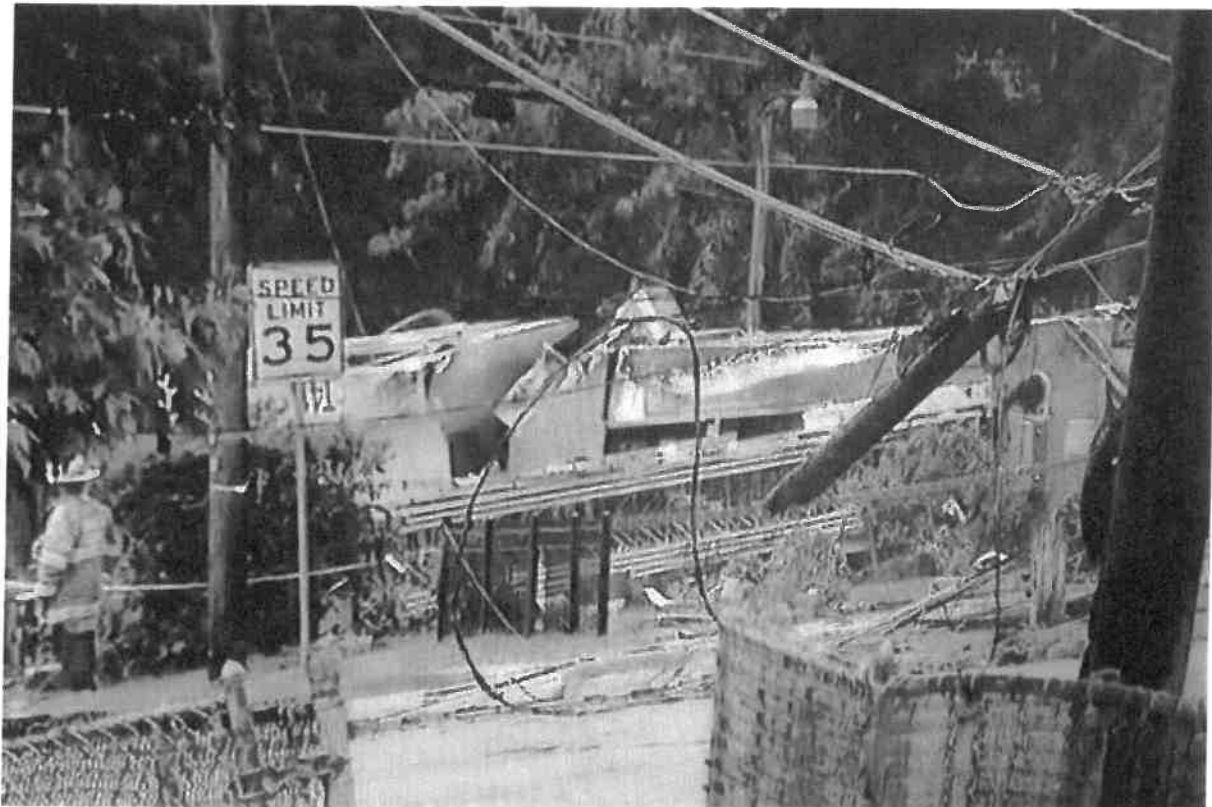
The fire truck, which landed on its side, hit a utility pole, causing power outages to an undetermined amount of customers.

The four firefighters who were on board the truck were all transported to a local hospital with non-life threatening injuries, Moreland said.

Police say it was raining heavily when the driver of the fire engine lost control and crashed in the area of Beacon Hill Road.

Dominion Power is currently working to restore power to those affected.

Officials expect to take about eight hours to clear the scene.





Three firefighters were sent to the hospital Tuesday night after their fire engine crashed on Zulla Road in Fauquier County. [LGFR photo]

## **Loudoun County Fire Engine Flips on Zulla Road, 3 Injured**

2019-01-16

Three firefighters were sent to the hospital Tuesday night after their fire engine crashed on Zulla Road in Fauquier County.

The crash happened just before 11 p.m., Jan. 15, as Middleburg Engine 603 was returning from a mutual aid emergency medical call in Fauquier County. The engine ran off the roadway, overturned and came to rest on its roof up against a utility pole, bringing down the power lines and disrupting service to homes in the area.

The three firefighters aboard were transported to Reston Hospital for treatment of non-life-threatening injuries. As of Wednesday morning, two of had been released and one remained in the hospital under observation.

The Fauquier County Sheriff's Office is investigating the crash.

# Montgomery County fire truck crashes and flips over while being taken in for maintenance



by Stephen Pimpo Jr./ABC7  
Thursday, November 15th 2018

*(Photo, Montgomery County Fire Department)*



FREDERICK COUNTY, Md. (ABC7) — A Montgomery County fire truck crashed and flipped on its side while driving through snow-covered roads on its way to undergo maintenance Thursday.

The Montgomery County Fire and Rescue Service said a vendor was taking Reserve Truck 3 to Hagerstown for repairs when it crashed and ended up on its side on Interstate 70 in the Myersville area of Frederick County.

Authorities say an off-duty Montgomery County firefighter helped the driver out of the wrecked truck.



# Traction Assistance Systems



## **Locking Differential**

A locking differential is beneficial as it allows torque to be developed in all wheels sharing an axle, regardless of their traction. The drive wheels will act like they are rotating on a common shaft. This way if one wheel has good traction it offers the ability to keep the truck moving. Without a locking differential, the wheels without traction may continue to spin with little torque being sent to the wheels with traction.

- 🔒 Never engage the differential lock above 25mph or while the wheels are spinning
- 🔒 When engaged, steering radius will increase
- 🔒 Disengage once the vehicle is freely moving—do not drive on dry pavement with the lock engaged
- 🔒 When tire chains are installed, do not attempt to turn the vehicle with the lock engaged.

## **Inter-axle Differential Lock (Tandem Axle Trucks)**

The inter-axle differential provides for necessary differential action between the axles of a tandem drive unit. This allows the wheels of either axle to revolve faster or slower than the wheels of the other axle in order to compensate for cornering, uneven road surfaces, and slightly different tire sizes. When encountering soft or slippery road conditions, the IAD can be locked out, eliminating any differential action between the axles.

- 🔒 Engage the IAD lock only when stopped or moving at slow speed. NEVER lock the IAD lock with the rear wheels spinning.
- 🔒 Disengage once the vehicle is freely moving—do not drive on dry pavement with the lock engaged.

## **Automatic Traction Control**

The ATC function automatically applies braking to a drive wheel that is spinning. Engine speed may also be decreased until traction is achieved. If it is desirable to rock the vehicle when stuck and the ATC is cutting the throttle, depress the mud and snow switch or other override provided by the chassis manufacturer.



### EMERGENCY VEHICLE OPERATOR CLASS "B"

Module 4  
Managing Risk – The Driver & The Situation



### OVERVIEW

- Driver fatigue
- Driver impairments
- Emotions
- Operational Situations
  - Intersections
  - Arriving
  - Railroad crossings
  - Tight clearance
  - Parking lots
  - Around the station



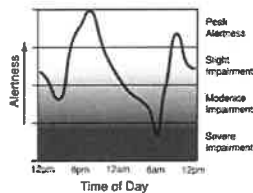
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Module 4

### DRIVER FATIGUE

- Not just falling asleep at the wheel
  - Falling asleep is an extreme form of driver fatigue
- Fatigue is tiredness, weariness or exhaustion
- Behavioral signs
  - changes in mood and motivation
  - failure to complete routines and
  - slower responses to questions or requests



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EVOB - Class B

Module 4

### DRIVER FATIGUE CAUSES

- Stress
- Lack of quality sleep or interrupted sleep patterns
  - apnea
- Substance abuse
- Prescription medications
- Irregular work hours
- Irregular meal times/eating habits



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EVOB - Class B

Module 4

### DRIVER FATIGUE EFFECTS

- increasing reaction time
- degrading attention and vigilance
- increasing distractibility and confusion
- decreasing motivation, and
- increasing the probability of driving performance errors



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EVOB - Class B

Module 4

### DRIVER FATIGUE PREVENTION

- Sleep schedule
  - Have a routine
- Sleep environment
  - Remove distractions
  - Dark, cool, clean
- Pre-bed snacks/drinks
  - No heavy foods or alcohol
  - No caffeine
- Exercise
  - Allow 3 hours for cool-down
- Diet
  - Avoid fatty or sugary food
- Naps
  - Not a substitute for night sleep
  - 20-30 minutes is good
  - >45 minutes is not good
- Shift schedule
  - Should you be working OT?

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Module 4

### DRIVER FATIGUE ON THE ROAD

- Get fresh air into your vehicle
- Keep your eyes moving
- Vary the siren pitch
- Maintain a conversation
- STOP



**No remedies fully offset the need for restful sleep!**

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Module 4

### OTHER IMPAIRMENTS

- Substance abuse
- Prescription medications
- Over-the-counter medications
- Physical issues
  - Vision
  - Hearing
  - Orthopedics

**You judge your readiness to drive.**  
**Remember** – it is not just YOU who is effected by your driving – it is your crew and the other vehicles around you. Don't be selfish.

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Module 4

### EMOTIONS

- Aggressive drivers/Road rage
- Response to siren – "sirencide"
- Call type
- State of mind/Outside influences
- Shift dynamic/communication skills

**CHECK  
YOURSELF  
BEFORE YOU  
WRECK  
YOURSELF!**

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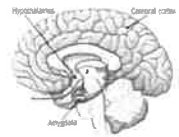
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Module 4

### EMOTIONS

When emotions overwhelm the operator:

- Tunnel vision/mission fixation may develop
- Vehicle speed increases
- Ability to prioritize actions appropriately is lost
- Communications break down



**A little stress is good – a lot is not**



Smith System "E.D.G.E." DVD

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Module 4

### Operational Situations

Intersections, Tight Clearance, Night Driving, Fire Stations, Positioning, Railroad Crossings

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11

### INTERSECTION BEHAVIORS

- Approaching
- Entering
- Jumping
- Other units



*Most likely location for an apparatus crash.*

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Module 4

### INTERSECTIONS APPROACHING

- One of the best proactive driving tactics is to reduce speed
- Adjust your speed to the available space cushion
  - Intersections are fixed object that as you close the gap you need to also reduce the stopping distance
- Reducing your speed gives other vehicles time to react to your approach
  - Let the play develop
- Change your siren cadence



REV. 04/10

EVOB - Class B

Module 4

### INTERSECTIONS APPROACHING

- Search ahead and identify potential hazards
  - Other vehicles
  - Pedestrians
  - Bicycles
  - Blind spots – buses, trees, buildings
  - Status of control devices – traffic lights, pedestrian crossing signals
- Identify the path of least resistance
  - Lane patterns
  - Avoid opposing traffic
- Cover the brake



REV. 04/10

EVOB - Class B

Module 4

### INTERSECTIONS SEARCH & IDENTIFY



REV. 04/10

EVOB - Class B

Module 4

### INTERSECTIONS SEARCH & IDENTIFY



REV. 04/10

EVOB - Class B

Module 4

### INTERSECTIONS SEARCH & IDENTIFY



REV. 04/10

EVOB - Class B

Module 4

### INTERSECTIONS ENTERING

- Entry occurs as soon as your front bumper crosses into cross-traffic
- If you cannot positively identify that right-of-way has been yielded to you, you must stop
  - Must do this for each individual lane
- Make eye contact with other drivers
  - Are other cars "acting" like they see you?
- Even when entering with the green light remain vigilant of other vehicles entering the intersection
- Avoid using the apparatus as a moving roadblock – this is aggressive driving

REV. 04/10

EVOB - Class B

Module 4

### INTERSECTIONS JUMPING

- Operator depresses the accelerator hard from stopped position
- Vehicle jerks or jumps forward
- Hard on the apparatus
- Jumps before other vehicle moves forward is a common low speed, at-fault collision
- Smooth starts allow for decision space

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Module 4

### INTERSECTIONS OTHER UNITS

- Zone of confusion - Created by two or more emergency vehicles responding together
  - Civilian driver sees one emergency vehicle, but hears a different one at the same time
  - Civilian driver thinks the coast is clear but pulls into your path
  - Elderly and teenagers are especially susceptible
- High-risk situation
- Anticipate other vehicles to make mistakes during the confusion



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Module 4

### INTERSECTIONS OTHER UNITS



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Module 4

### INTERSECTIONS OTHER UNITS

It happened here.

Engine 23 struck Ambulance 21 as they both entered an intersection enroute to a Hazmat Box.



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EVOC - Class B

Module 4

### INTERSECTIONS PROCESSION RESPONSE

- Travel single file with largest vehicle leading to create a path
- Maintain space cushions
  - Expect the leading unit to stop
- Each vehicle must use the normal precautions
  - Proceed as though no other units already entered
- Use contrasting siren tones
  - electronic siren with alternating or pulsing tone.



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Module 4

### CASE STUDY #1

- Contributing Factors?
- MCFRS Guidelines
- Civil suit - 2014
  - Wrongful death
  - \$186,000



July 26, 2010  
Two FF killed

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EVOC - Class B

Module 4

# MCFRS EVO Class B Course

## Module 4

### ARRIVING

- Deceleration
- Finding the address
- Apparatus positioning
- Parking



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EVOC - Class B

Module 4

### ARRIVING DECELERATION

- Allow the auxiliary braking systems to work
- Hard stops
  - Harsh on apparatus, equipment, crew
  - Indicates operator was not scanning ahead
- Smooth deceleration stops
  - Plan ahead
  - Good visual lead time – ¼ mile ahead
  - Pick your stopping point on horizon
  - Decelerate early

Deceleration Video

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EVOC - Class B

Module 4

### ARRIVING FINDING THE ADDRESS

- Common element leading to crashes is passing the address
  - U-Turns in traffic
  - Backing against traffic
  - Operator gets frustrated
- Preplan & teamwork
- Know block numbers
- Know the cross street before the target block or identify "catching features"
- Reduce speed on the target block
- Use scene lighting
- Stop and read the map book

**Class B  
apparatus are  
not simple to  
turn around!**

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EVOC - Class B

Module 4

### ARRIVING POSITIONING

- Approach the final spot slowly
- Spot for tactical advantage
- Leave clear space around vehicle
- Compartment doors
- Walking paths
- Outriggers
- Drive out instead of back out
- Leave access for incoming companies



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EVOC - Class B

Module 4

### ARRIVING POSITIONING CONSIDERATIONS

- Assume passing motorists do not see the apparatus or the personnel on the roadway
- Situational positioning
  - Action areas
  - Cast a large shadow
  - Pump panel area
  - Smoke conditions
  - Hazmats
- Do you need to be on the road at all?



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EVOC - Class B

Module 4

### ARRIVING BEACHING

- Some situations encourage leaving the roadway
  - Tactical advantage for operations
  - Leaving space for other units
- What advantage is being gained by leaving the roadway?
- Will the surface support the apparatus?
- Will the entire apparatus be off the road or just some of the wheels?
- Can the apparatus get far enough off the road to actually offer a tactical advantage?



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Module 4

### ARRIVING PARKING

- Come to a complete stop
- Transmission to neutral
- Set the spring brake
- Place a wheel chock
  - Redundant parking brake
  - Downgrade side
  - Required for parked vehicles either attended and unattended
  - Light vehicles can use parking brake
  - Turn wheels toward curb
  - Mark of a professional operator



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EVOC - Class B

Module 4

### LIMITED ACCESS ROADS

- Higher speeds
  - Less reaction time
  - Greater reaction forces
  - Less siren distance
  - Being out run
- Driving on the shoulder
  - Anticipate other vehicles moving into your path
  - Slow down
  - Siren or no siren?



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EVOC - Class B

Module 4

### RAILROAD CROSSINGS

- MCFRS policy requires stops at unguarded crossings
  - Approach guarded crossings with skepticism
- Stop, look, and listen in both directions
- Trains may travel in either direction on all tracks
- Wait a moment to proceed after a train passes
- Never park or stop on train tracks
- More than one railroad or agency may operate on a set of tracks
  - Halting train traffic may be difficult



Collision video

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EVOC - Class B

Module 4

### TIGHT CLEARANCE

- Public roadways are typically 9 to 12 feet wide dependent upon speed and traffic volume
- Apparatus widths are:
  - 2008 Crimson – 9' 9"
  - 2016 Freightliner EMS Unit – 9' 6"
  - 2016 Pierce Arrow – 9' 8"
  - SUV – 7'
- Private driveways, alleys, and other non-public roadways have no standard



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Module 4

### TIGHT CLEARANCE



Connecticut Avenue - Chevy Chase



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Module 4

### TIGHT CLEARANCE TURN LANES



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EVOC - Class B

Module 4

### TIGHT CLEARANCE



rev. 6/4/18

EVOC - Class B

Module 4

### TIGHT CLEARANCE

- Your margin for error with a 20 or 35-ton vehicle can be inches.
- How fast should you be going?
  - How important is it to squeeze through?
  - Will the situation clear if you wait?



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EVOC - Class B

Module 4

### TIGHT CLEARANCE WHEN YOU MUST GO

- Expand your "look ahead" distance
- Use spotters to assist the driver
- Crowd or change lanes
  - Must know what is going on around the vehicle and have complete situational awareness
  - Do not run other vehicles out of their lane
- Use appropriate speed
  - Time to identify obstacles, decide options, and execute the maneuver
- Best visibility for the driver is the driver's side of the apparatus
  - Keep the driver's side of the apparatus as close as reasonable to the fixed objects
  - Use mirrors to watch clearances as fixed objects are passed.

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Module 4

### UNDERBODY CLEARANCE

- Angle of approach
- Angle of departure
- Underbody clearance
- Clearances can vary
  - Unit to unit
  - Same unit; different conditions
  - Prior damage



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EVOC - Class B

Module 4

### UNDERBODY CLEARANCE

- Apparatus components may drag when transitioning between surfaces
  - Parking areas
  - Driveways
  - Curbs
  - Medians — paved or unpaved
- Damage prevention
  - Signs of prior damage on pavement
  - First due knowledge
  - Approach or depart at an angle



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EVOC - Class B

Module 4

### NIGHT DRIVING

- All of the same hazards as daytime driving, but with less visibility
- Most drivers use the same approach to driving day or night
- Night-time driving problems are not recognized or understood
- Fatal collision rates are 3x higher at night
- More encounters with impaired drivers
- Prime time for road closures or work



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EVOC - Class B

Module 4

### NIGHT DRIVING CHALLENGES

- Difficulty with visual perception
- Eyes adapting to changing levels of brightness
  - Other drivers blinding you
  - You blinding other drivers
- Visual "cues" at darkness are eliminated
- Shorter and narrower fields of vision
- Limited or no visibility in mirrors and to the rear
- Reduced level of alertness (fatigue)
- Seniority



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EVOG - Class B

Module 4

### NIGHT DRIVING GLARE

The human eye takes about 7 seconds to fully recover from being blinded by bright light.

In 7 seconds, a vehicle traveling 60mph will travel 616 feet.



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EVOG - Class B

Module 4

### NIGHT DRIVING PRECAUTIONS

- Know the range of your headlights
- Reduce speed and increase following distances



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EVOG - Class B

Module 4

### NIGHT DRIVING PRECAUTIONS

- Avoid driving while fatigued whenever possible
- Keep your eyes moving to avoid glare and fixating
- Recognize that your warning lights and floodlights will create glare for other drivers
- Reduce glare inside the cab by using red overhead lights, dimming the MDT screen, and dimming the panel lights
  - Communicate to the crew when lights in the rear of the cab are a problem
- Keep your windshield, headlights and warning lights clean

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EVOG - Class B

Module 4

### PARKING LOTS

- Immediately limited clearance
- Physical Hazards
  - Tight corners
  - Landscape trees overhanging lanes
  - Protective bollards
  - Light poles
  - Landscape rocks
  - Illegal parking — fire lanes
- Pedestrians
- Distracted drivers
- Adjust time of day if possible
- Avoid entering parking lots whenever possible
- Choose your parking spot
- Should you park?

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EVOG - Class B

Module 4

### AROUND THE FIREHOUSE

#### Leaving the Bay

- Complete a visual check
- Disconnect shorelines
- Verify the door is fully open
- Verify the crew is ready
  - Seated, belted, doors closed
- Leave slowly
- Engage any traffic control

#### Overhead Doors

- When the door is in motion you should be stationary
- Do not rely upon collision sensors
- Sensors are for human safety
  - Too slow to avoid apparatus
- Know how your doors work!

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EVOG - Class B

Module 4

### SUMMARY



- Apparatus operators must judge their own ability to perform when faced with fatigue or emotional stress
  - Do not be selfish – other people's lives are relying upon your readiness
- Fire apparatus face a variety of situations that increase the risk of collisions
  - Intersections pose the most serious and frequent threat for a severe collision
  - Congested areas restrict your ability to act so you must slow down
  - Know the six sides of your apparatus – not just the height and width
  - Everyday errands can lead you into collision-prone areas and combine with complacency due to familiarity

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EVOB - CLASS B

Module 4



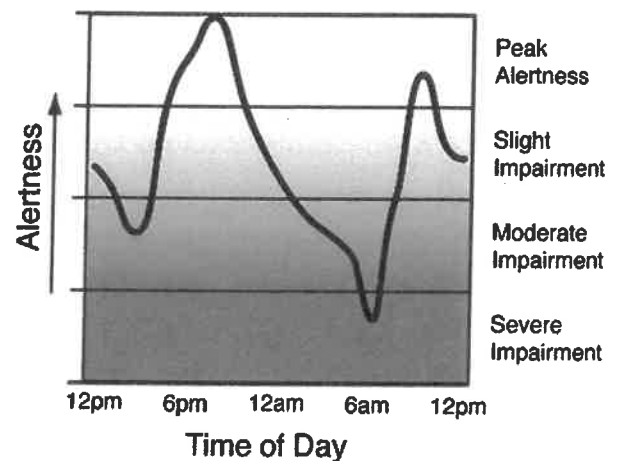


# Driver Fatigue

Interruptions to sleep are an inevitable part of the job. You need to recognize when fatigue has *impaired* you or a co-worker. Control the things you can control within your life to reduce the development of fatigue.

## SIGNS

- Changes in mood
- Failure to complete routines
- Increased reaction time
- Degraded attention and vigilance
- Increased distractibility and confusion
- Decreased motivation



## PREVENTION

- ✓ Set a routine for sleep to maintain a rhythm for your body—go to bed and get up at the same time every day
- ✓ Remove distractions from your sleep environment such as phones or computers (sorry, Motorola has to stay!)
- ✓ Create a comfortable and clean sleep environment
- ✓ Avoid heavy foods, alcohol, and caffeine before bed
- ✓ Allow about 3 hours between exercise and bed time to let your

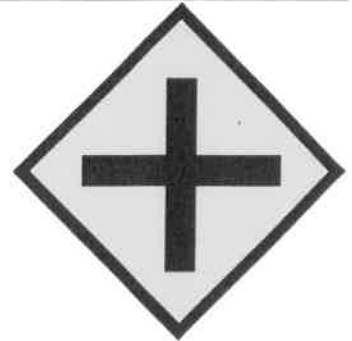
### "Safety" Naps

**Not a substitute for nighttime sleep**  
**Short naps improve mood, alertness, and performance**  
**Limit to 20 to 30 minutes**  
**Longer than 45 minutes can be counterproductive—grogginess**



# Intersections

One of the most hazardous and frequent tasks of an apparatus operator is to navigate intersections.



Emergency vehicles are granted the privilege of passing a red or stop signal only when using both audible and visual signals.

Apparatus entering an intersection must do so at a speed that would allow them to safely yield the right of away to a civilian vehicle to avoid a collision.

When approaching an intersection in traffic apparatus operators should be covering the brake pedal to reduce reaction time and anticipate the need to brake.

When entering an intersection against a traffic signal, each lane must be treated as a separate intersection. Account for traffic in each individual lane and never assume an approaching driver notices your apparatus.

Make eye contact with other drivers and watch their "body language" to anticipate their actions. Impatient or confused drivers often give warning signs that they are not going to yield to your apparatus.

On a multi-lane road be especially wary of lanes that are not yet controlled by vehicles that have yielded to you. Drivers further back in traffic may see the open lane as an opportunity to accelerate through the intersection to bypass the stopped vehicles. The open lane also enables traffic to approach at higher rates of speed. Further complicating the situation is traffic that is already stopped obscuring your view of the oncoming vehicle or the oncoming vehicle's view of you. People see a green light and want to GO.

Account for all lanes, including turn lanes, before fully committing to an intersection. Recognize that civilian drivers may not always do the right thing, such as using a turn lane to circumvent stopped cars, running a yellow or red light, or simply electing to not yield the right-of-way to you.

Know the response patterns of surrounding apparatus. Look and listen for other converging units as you approach intersections. Anticipate other units approaching the scene, including police. If you have known convergence points within your normal run routes consider announcing your approach on the radio to forewarn other units.

Slow well ahead of intersections and allow other drivers an opportunity to hear, see, and react to your approach. As a running back in football allows the play to develop ahead of them, you too should be giving traffic a chance to make their move before you work your way through.

All personnel on the apparatus need to be scanning for hazards during transit.



# Around the Station

**MANY AVOIDABLE VEHICLE INCIDENTS OCCUR IN  
AND AROUND THE FIRE STATIONS.**

## **Leaving the bay**

- ✓ Complete a visual check around the apparatus before entering the cab
- ✓ Ensure the shore line disconnects
- ✓ Verify the overhead door is fully open before moving
- ✓ Proceed slowly onto the station apron prepared to stop for pedestrians or other apparatus
- ✓ Engage any traffic control devices and allow them to control traffic



## **Overhead doors**

Never drive through while an overhead door is in motion

Do not rely upon electronic sensors to keep a door from closing on apparatus

Electronic sensors are designed to keep humans from being crushed by the door; they will not reverse the door fast enough to avoid a collision with apparatus

Know the operating characteristics of the overhead doors in the station

- Are they on a timer?
- How is the timer activated?
- Is there a way to cancel the timer?
- Are the collision sensors working? Are they positioned to sense the apparatus that is in that bay? Aerial Towers pass through the bay doors differently than a Freightliner ambulance.



## **Driving when taking medications.**

Driving is a complex skill. Our ability to drive safely can be affected by changes in our physical, emotional and mental condition. The goal of this information is to help you and your health care professional talk about how your medicine may affect your ability to drive safely.

### **How can medications affect my driving?**

People use medicines for a variety of reasons, including:

- ✓ allergies
- ✓ anxiety
- ✓ cold
- ✓ depression
- ✓ diabetes
- ✓ heart and cholesterol conditions
- ✓ high blood pressure
- ✓ muscle spasms
- ✓ pain

Medicines include medications that your doctor prescribes and over-the-counter medications that you buy without a doctor's prescription. Many individuals also take herbal supplements.

Some of these medicines and supplements may cause a variety of reactions that may make it more difficult for you to drive a car safely. These reactions may include:

- sleepiness
- blurred vision
- dizziness
- slowed movement
- fainting
- inability to focus or pay attention
- nausea

Often people use more than one medicine at a time. The combination of different medicines can cause problems for some people. Due to changes in the body as people age, older adults are more prone to medicine related problems. The more medicines you use, the greater your risk that your medicines will affect your ability to drive safely. To help avoid problems, it is important that at least once a year you talk to your doctor, nurse, or pharmacist about all the medicines – both prescription and over-the-counter – you are using. Also let your doctor know what herbal supplements, if any, you are using. Do this even if your medicines and supplements are not currently causing you a problem. Be sure that the health care professional understands the requirements of driving for work.

### **Can I still drive safely if I am taking medications?**

Yes, most people can drive safely if they are using medications. It depends on the effect those medicines – both prescription and over-the-counter – have on your driving. In some cases you may not be aware of the effects. But, in many instances, your doctor can help to minimize the negative impact of your medicines on your driving in several ways. Your doctor may be able to:

- ✓ Adjust the dose;
- ✓ Adjust the timing of doses or when you use the medicine;
- ✓ Add an exercise or nutrition program to lessen the need for medicine; and
- ✓ Change the medicine to one that causes less drowsiness.

## **What can I do if I am taking medications?**

Talk to your doctor honestly. When your doctor prescribes a medicine for you, ask about side effects. How should you expect the medicine to affect your ability to drive? Remind your doctor of other medicines – both prescription and over-the-counter – and herbal supplements you are using, especially if you see more than one doctor. Talking honestly with your doctor also means telling the doctor if you are not using all or any of the prescribed medicines. Do not stop using your medicine unless your doctor tells you to.

Ask your doctor if you should drive — especially when you first take a medication. Using a new medicine can cause you to react in a number of ways. It is recommended that you do not drive when you first start using a new medicine until you know how that drug affects you. You also need to be aware that some over-the-counter medicines and herbal supplements can make it difficult for you to drive safely.

Talk to your pharmacist. Get to know your pharmacist. Ask the pharmacist to go over your medicines with you and to remind you of effects they may have on your ability to drive safely. Be sure to request printed information about the side effects of any new medicine. Remind your pharmacist of other medicines and herbal supplements you are using. Pharmacists are available to answer questions wherever you get your medicine. Many people buy medicines by mail. Mailorder pharmacies have a toll-free number you can call and a pharmacist available to answer your questions.

Monitor yourself. Learn to know how your body reacts to the medicine and supplements. Keep track of how you feel after you use the medicine. For example, do you feel sleepy? Is your vision blurry? Do you feel weak and slow? When do these things happen?

## **Moral obligation to report.**

You may not want to ask a doctor about the side effects of a medication or inform your supervisor of something that might restrict your ability to work. It takes courage to voluntarily provide information that might alter your driving status. However, to conceal medical conditions or medications that can impact your driving performance is a selfish act that potentially endangers you, your crew, and the citizens we serve.

For additional information, personnel should refer to MCFRS Policy 01-02 *Medical Standards for Operational Members and Candidates of MCFRS*.

### EMERGENCY VEHICLE OPERATOR CLASS "B"

Module 5  
Apparatus Positioning & Roadway Safety



### MOTIVATION

- MCFRS responds to over 100,000 incidents annually
- Nearly every incident requires operators to position for:
  - Operational efficiency
  - Crew safety
- Operational efficiency
  - EMS equipment
  - Hoseline deployment
  - Ground and aerial ladder deployment
  - Master stream reach
- Crew safety
  - Between 2000 and 2013, 61 firefighters have been killed when struck by vehicles
  - Nearly half of the deaths were on non-fire incidents



### MONTGOMERY COUNTY EXPERIENCE



January 6, 2016 @ 1615hrs – A719 struck while blocking



February 15, 2015 @ 0015hrs – A711 struck while on the shoulder

### MONTGOMERY COUNTY EXPERIENCE



"...we stopped and were hit within 30 seconds."

### FEDERAL & STATE STANDARDS

#### Definition of a "Traffic Incident"

A **traffic incident** is defined as any non-recurrent event, (vehicle crash, vehicle breakdown, special event) that causes a reduction of roadway capacity or an abnormal increase in traffic demand or congestion.

Maryland Manual on Uniform Traffic Control Devices – Section 6I

### WORK ZONE

- Every incident requires establishing a work zone to some degree
- Focus is traditionally on vehicle crashes or on highways
- Upon approach to a scene the apparatus operator must assess how best to protect their crew and the scene from oncoming traffic
- Any time apparatus will impede or effect open traffic lanes some form of work zone must be established

### ROADWAY TERMS

- Lane Identification
  - Number left to right
- "CD" lanes
  - Route 270
  - Collector distributor
  - Local lanes
- "Main" lanes
  - Through lanes on Route 270



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Module 5

### ROADWAY TERMS



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### ROADWAY TERMS

'Upstream' or 'downstream' refers to the direction of normal vehicle travel on the road, street or highway.

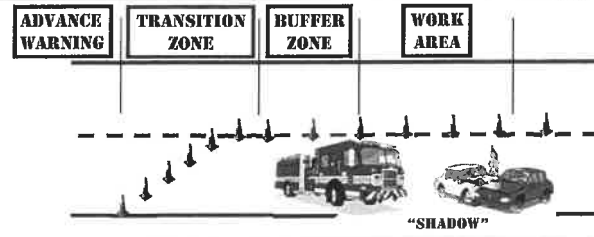


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### WORK ZONE TERMS



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Module 5

### CONTROLLING THE EXPOSURE

- Time
  - Clear the scene efficiently
  - Reduce the assignment
- Distance
  - Use a space buffer between you and traffic
  - Provide advanced notice downstream
- Shielding
  - Blocking apparatus
  - Traffic control devices

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### TRAFFIC CONTROL DEVICES CONES, FLARES, SIGNS

Use flares to illuminate cones at night or bad weather



MUTCD provides standards for cones - size and reflectivity



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Module 5

### EXPOSURE TIME "QUICK CLEARANCE"

- DOT and PD want the road open
- Citizens want the road open
- Operational goals should include:
  - Minimize time on scene
  - Open lanes to return traffic to normal
  - Reduce the potential for secondary crashes downstream



MC 5-01.1

EVOB - Class B

Module 5

### BUFFER SPACE LANE + 1



If moving traffic occupies this lane, is there an adequate "buffer"?



MC 5-01.2

EVOB - Class B

Module 5

### PRIORITIES OF THE FIRST ARRIVING UNIT

- Block
- Prioritize the moving traffic hazards
- Set out traffic control devices
- Protect the loading area for the ambulance and work area for crews



MC 5-01.3

EVOB - Class B

Module 5

### BLOCKING APPARATUS

"Blocking" is the action of positioning an apparatus or vehicle at an angle to halt or divert the flow of moving traffic in one or more lanes. Blocking apparatus may be a unit with other duties or solely dispatched for traffic control.



MC 5-01.4

EVOB - Class B

Module 5

### BLOCKING APPARATUS

- Blocking apparatus should not be occupied
- Avoid blocking partial lanes
- Beware that gaps behind or in front of the apparatus allow cars to enter your work area



MC 5-01.5

EVOB - Class B

Module 5

### BLOCKING APPARATUS

This Engine blocks the left and center lanes. This "block to the right" directs all upstream traffic into the right lane.



MC 5-01.6

EVOB - Class B

Module 5

### BLOCKING APPARATUS

A "Shadow" is the area immediately downstream of any apparatus or vehicle that blocks moving traffic

Work within this "shadow" area for greatest degree of safety and protection from moving traffic.



MC 547.1

EVOB - Class B

Module 5

### TEMPORARY TRAFFIC CONTROL ZONE

- TTC zone is created by the blocking apparatus
- All response activities must occur within this protected zone



MC 547.2

EVOB - Class B

Module 5

### PROTECT THE AMBULANCES



The patient "loading area" at the rear of the ambulance must be within the protected area



Ambulances may be parked at an angle that puts the loading area deep in the shadow

MC 547.3

EVOB - Class B

Module 5

### ADVANCE WARNING

- Beware of short sight distances
- Curves, hills, access ramps, vegetation
- Position apparatus, traffic control devices, and/or warning signs ahead of the scene



MC 547.4

EVOB - Class B

Module 5

### ADVANCE WARNING

- Familiarize yourself with known dangerous locations
  - I-495 b/n River Road and Wisconsin Ave
  - Any other examples?
- May require placing apparatus further from the scene than normal



MC 547.5

EVOB - Class B

Module 5

### ADVANCE WARNING

- On extended incidents, advance warning signage may be set up
- Federal standards provide guidance on the signage
  - Fluorescent pink reflective
  - Minimum of 36" x 36"



MC 547.6

EVOB - Class B

Module 5

### CONE SPACING GUIDELINES

- In general, cone spacing depends on the posted speed and the function of the cone within the work zone
- Rules of thumb for cone spacing
  - <45mph – 20'
  - >45mph – 40'
- You may have to prioritize/triage cone placement due to the limited quantity of cones on the apparatus
  - The apparatus may mark the transition and the cones parallel to the work area

### YOU ARE A SOFT TARGET

- ✓ Drunk,
- ✓ Drugged,
- ✓ Drowsy,
- ✓ Distracted
- ✓ Dumb
- ✓ Disoriented

Traffic vests and turnout gear do not stop the "D" Drivers...

Cones and flares do not stop the "D" Drivers...

Here lies the subject of a NIOSH report

### SUBJECT OF THE REPORT

2007 - One firefighter was struck by a vehicle and killed. He was at the scene of a vehicle fire shortly after 4:00 am, loading hose back onto fire apparatus in the right-hand lane on an interstate highway when he was struck by a bus traveling approximately 65 mph. The driver of the bus had not noticed the emergency lights of fire apparatus parked on the shoulder and in the right-hand travel lane or traffic cones set up near the fire scene, and was traveling in the right-hand lane. When he belatedly tried to change lanes, he sideswiped the first apparatus and struck the firefighter. The fire department had declined traffic control on the highway during their operations at the vehicle fire because there was no traffic on the road.

### SUBJECT OF THE REPORT

2010 - A firefighter who was directing traffic at the scene of a motor vehicle crash was struck by a vehicle whose driver drove over traffic cones that had been set out to close the road. A flare had been placed near the cones. The victim was wearing coveralls with some reflective material and a high-visibility hat, and was using a flashlight with a traffic wand. However, he had his back to oncoming traffic and had positioned his vehicle, with emergency lights operating, beyond the point where the road was closed. Factors in the death included no advance warning to drivers, inconspicuousness of the victim and careless driving.

### SUBJECT OF THE REPORT

2011 - A firefighter directing traffic at a motor vehicle crash on a highway was struck while trying to keep the left-hand lane closed to traffic. A driver came over the hill, tried to maneuver around slowed traffic and struck the victim, who was wearing personal protective equipment and a reflective vest. Speed and alcohol were not factors in the incident.

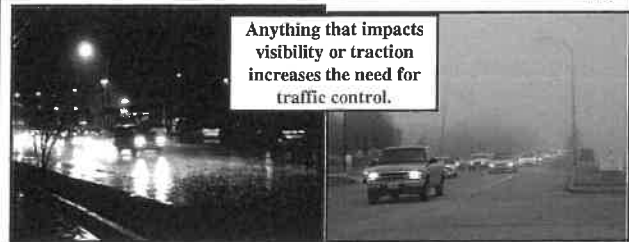
### SUBJECT OF THE REPORT

2012 - The firefighter was killed at the scene of a motor vehicle crash when another driver deliberately struck him and two other emergency responders. The victim was wearing a high visibility vest, was standing close to traffic and was not protected by the positioning of the emergency apparatus.

### SUBJECT OF THE REPORT

2006 - The victim was spray painting markings on a highway to indicate the location of hydrants. He stopped his brush truck in the passing lane of the roadway, leaving the hazard lights operating, and worked in front of the truck. A vehicle approaching at close to the speed limit in the same lane rear-ended the truck, which crushed the firefighter.

### BAD WEATHER



Anything that impacts visibility or traction increases the need for traffic control.

### GOOD WEATHER

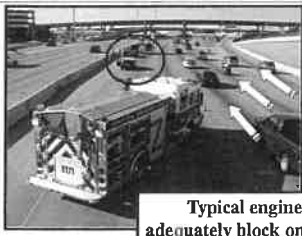


Sun glare impacts visibility in good weather!!

### KNOW YOUR ROLE

- What was your dispatched arrival order?
- What is your actual arrival order?
- Has any other unit taken up a blocking position?
  - Is traffic approaching from more than one direction?
- What is the primary assignment?
  - Will you be accessing your compartments or hose loads?
  - Can your unit be abandoned and left as a road block?

### BLOCKING UNIT



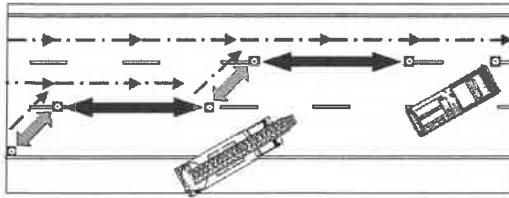
Typical engine company cannot adequately block on a multi-lane highway

### BLOCKING UNIT

Use a second heavy apparatus to block.



### STAGGERED BLOCKING



rev. 6-17-18

EVOB - Class B

Module 5

### GAP ANALYSIS

- Where can another vehicle come through to the scene?
- Is this a good blocking position?



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Module 5

### JUMPING THE BARRIER



Southbound ambulance crew stops and jumps the median for a patient on the northbound shoulder....

Should NOT be permitted!!

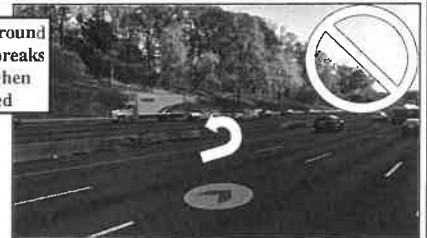
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Module 5

### MEDIAN CROSSINGS & TURNAROUNDS

Policy forbids turning around at median crossings or breaks in the center barrier when traffic is uncontrolled



rev. 6-17-18

EVOB - Class B

Module 5

### MEDIAN CROSSINGS PGFD EXPERIENCE

- E828 used a break in the median
- Returning to quarters
- I-495 near Route 50
- Struck from behind by a tractor-trailer
- 4 FF injured; one severely



rev. 6-17-18

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Module 5

### SCENE LIGHTING

- Pro's
  - Makes the scene and personnel visible
  - Identifies the work area
  - Augments apparatus warning lights
- Con's
  - Blinding to oncoming motorists
  - Makes the scene visible



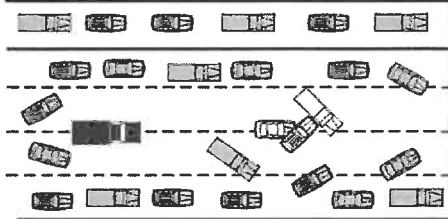
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Module 5

### FIRST ARRIVING?

You arrive first on a crash on the interstate. Where do you park and why? What are your priorities?



100-5474

EVOG - Class B

Module 5

### ROADWAY SURVIVAL

- Apparatus position does not eliminate the need for personal situational awareness
- Personnel are exposed when:
  - Getting out of the unit
  - Walking around the unit
  - Retrieving equipment from the unit
  - Getting into the unit
  - Spotting for the unit

**Don't forget the civilians!**



100-5474

EVOG - Class B

Module 5

### ROADWAY SURVIVAL

- Give consideration for protecting the most people most of the time
  - Which side(s) of the apparatus contain the equipment you will need?
  - Will the pump operator need to be protected at the panel?
- Most fire apparatus crew areas allow members to exit out either side of the unit
- The driver should check side mirrors just before people dismount – look for incoming vehicles

100-5474

EVOG - Class B

Module 5

### ROADWAY SURVIVAL

- Stop, look, and listen.....before you walk around the corner of an apparatus
- Try to position yourself to face oncoming traffic when getting equipment from the apparatus
- Always avoid placing yourself between oncoming traffic and your apparatus – the rock and the hard place
- Consider angling the apparatus every time you park on a roadway, even at the curb

100-5474

EVOG - Class B

Module 5

### ROADWAY SURVIVAL EXITING THE CAB

Maintain a "Low Profile"  
Do NOT open door fully  
Do NOT walk around end of open door



Drivers and Officers cannot choose the side they exit

100-5474

EVOG - Class B

Module 5

### ROADWAY SURVIVAL EXITING THE PATIENT COMPARTMENT

Maintain "Low Profile"  
Do NOT open door fully  
Do NOT walk around end of an open door  
Minimize your time in the doorway



100-5474

EVOG - Class B

Module 5

### ROADWAY SURVIVAL EMS UNIT LOADING

Protect the rear of EMS Transport Units.  
If the rear loading area is not within the shadow of another unit, consider positioning at an angle or in a protected area.



1st S&F

EVOB - Class B

Module 5

### ROADWAY SURVIVAL PERSONAL VISIBILITY

- MCFRS Policy 26-07AM – Use of Traffic Vests
  - incident scenes on arterials/highways/streets
  - All personnel on scene must wear a:
    - traffic safety vest ;or
    - structural firefighting coat ;or
    - sector/command vest
- Flashlights
  - Attention grabber
  - Be cautious not to blind drivers



1st S&F

EVOB - Class B

Module 5

### ROADWAY SURVIVAL PERSONAL VISIBILITY



Do you see all of the responders?



Open sided vests offer limited protection on roadways

1st S&F

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Module 5

### ROADWAY SURVIVAL PERSONAL VISIBILITY

Who can you see?



1st S&F

EVOB - Class B

Module 5

### APPARATUS POSITIONING MARYLAND CODE - § 21-405

(e) Unless otherwise directed by a police officer or a traffic control device, when an emergency vehicle using any visual signal is stopped, standing, or parked on a highway, the driver of a motor vehicle approaching the emergency vehicle from the rear shall:

- (1) make a **lane change** into an available lane not immediately adjacent to the emergency vehicle; or
- (2) **slow to a reasonable** and prudent speed that is safe for existing weather, road, and vehicular or pedestrian traffic conditions.

1st S&F

EVOB - Class B

Module 5

### AUTO FIRE VIDEO

- Limited access roadway
- 55mph speed limit
- Foggy and misty weather
- Christmas night
- 2 engines, 1 EMS unit



1st S&F

EVOB - Class B

Module 5

# MCFRS EVO Class B Course

## Module 5

### SUMMARY



Position yourself and your apparatus for maximum visibility and protection.

Do not rely upon traffic cones or flares to stop a vehicle.

Treat the roadway like an IDLH atmosphere.

*Every time you are in the road – not just on calls.*

11/15/18

EVO - Class B

Module 5

## **INCIDENT OPERATIONS IN OR NEAR VEHICLE TRAVELWAYS**

### **Overview**

This document identifies general principles to apply when arriving and working on the scene of incidents on open roadways. It includes parking practices for heavy apparatus and support vehicles that will provide maximum protection and safety for personnel operating in or near moving vehicle traffic. It also identifies several approaches for individual practices to keep firefighters safe while exposed to the hazardous environment created by moving traffic.

**It is an objective to position apparatus and other emergency vehicles at incidents on any street, road, highway or expressway in a manner that best protects the incident scene and the work area. Such positioning will afford protection to fire department personnel, law enforcement officers, tow service operators and the motoring public from the hazards of working in or near moving traffic.**

Treat vehicular traffic areas with the same caution as any other environment that is immediately dangerous to life and health. At nearly every emergency scene, personnel are exposed to passing motorists of varying driving abilities. Approaching vehicles may be driven at speeds from a creeping pace to well beyond the posted speed limit. Some of these vehicle operators may be vision impaired, under the influence of alcohol and/or drugs, or have a medical condition that affects their judgment or abilities. In addition, motorists may be completely oblivious to your presence due to distractions caused by cell phone use, loud music, conversation, inclement weather, emotional distress, and terrain or building obstructions. Approaching motorists will often be looking at the scene and not the roadway in front of them.

Nighttime incidents requiring personnel to work in or near moving near traffic are particularly hazardous. Visibility is reduced and driver reaction time to hazards in the roadway is slowed.

## TERMINOLOGY

The following terms are commonly used during incident operations, post-incident analysis and training activities related to working in or near moving traffic.

**Advance Warning-** notification procedures that advise approaching motorists to transition from normal driving status to that required by the temporary emergency traffic control measures ahead of them.

**Block-** positioning a fire department apparatus on an angle to the lanes of traffic creating a physical barrier between upstream traffic and the work area. Includes 'block to the right' or 'block to the left'.

**Buffer Zone-** the distance or space between personnel and vehicles in the protected work zone and nearby moving traffic.

**Downstream-** the direction that traffic is moving as it travels away from the incident scene.

**Flagger-** a fire department member assigned to monitor approaching traffic and activate an emergency signal if the actions of a motorist do not conform to established traffic control measures in place at the highway scene.

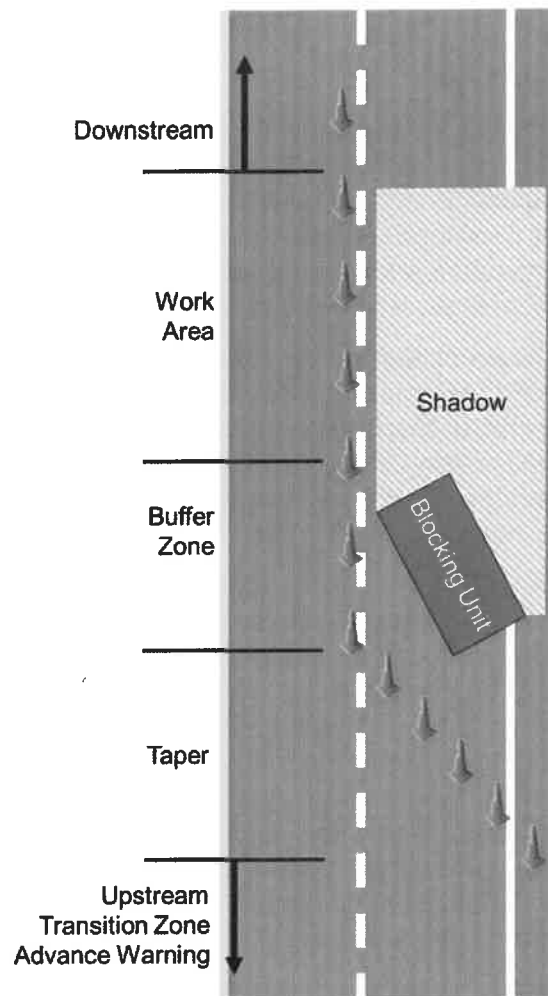
**Shadow-** the protected work area that is shielded by the block from apparatus and other emergency vehicles.

**Taper-** the action of merging several lanes of moving traffic into fewer moving lanes.

**Temporary Work Zone-** the physical area of a roadway within which emergency personnel perform their fire, EMS and rescue tasks at a vehicle-related incident.

**Transition Zone-** the lanes of a roadway within which approaching motorists change their speed and position to comply with the traffic control measures established at an incident scene.

**Upstream-** the direction that traffic is traveling from as the vehicles approach the incident scene.



## **SAFETY BENCHMARKS**

All emergency personnel are at great risk of injury or death while operating in or near moving traffic. There are several specific tactical considerations that should be taken to protect all crew members and emergency service personnel at the incident scene including;

1. Never trust approaching traffic.
2. Avoid turning your back to approaching traffic.
3. Establish an initial "block" with the first arriving emergency vehicle or fire apparatus.
4. Follow MCFRS Policy #26-07AM regarding the use of high visibility attire.
5. Be aware that apparatus lights and scene lights may impair the vision of approaching motorists. Use good judgement when setting up portable lighting, be selective about which fixed scene lighting to engage on apparatus, and turn off scene lighting that isn't supporting operations.
6. Use emergency vehicles to initially redirect the flow of moving traffic and set the stage for additional traffic control measures.
7. Establish advance warning and adequate transition area traffic control measures upstream of incident to reduce travel speeds of approaching motorists.
8. Deploy traffic cones to augment apparatus positioning for sustained traffic control and direction. During low-visibility periods, road flares may be intermingled with the cones for increased effectiveness.
9. Designate a fire department member assigned to the "Flagger" function to monitor approaching traffic and activate an emergency signal if the actions of a motorist do not conform to established traffic control measures in place at the highway scene.

## **APPARATUS AND EMERGENCY VEHICLE PRACTICES**

In addition to positioning for vehicle function, i.e. deploying hose, ladders, and equipment, apparatus operators must consider the impact of positioning on the work zone established immediately upon arrival at a scene. Listed below are benchmarks for positioning of apparatus and emergency vehicles when operating in or near moving traffic. This information is not limited to high-speed or primary roads, but should be applied when operating on any active vehicular traffic area.

1. Always position first-arriving apparatus to protect the scene, patients, and emergency personnel.
  - a. Initial apparatus placement should create a work area protected from traffic approaching in at least one direction.

- b. Angle apparatus on the roadway with a “block to the left” or a “block to the right” to create a physical barrier between the scene and approaching traffic.
  - c. Allow apparatus placement to be visible to approaching motorists, slow them, and redirect them around the scene. Be especially cautious on curves, on hill crests, and other areas where sight distance may be limited.
  - d. Use fire apparatus to block at least one traffic lane more than that already obstructed by the incident to create a buffer space. Do not block partial lanes – take all of the lane or none of it.
  - e. Whenever possible, position blocking apparatus to eliminate the possibility of a stray vehicle passing through the work zone. Close gaps on the shoulders and take advantage of existing obstacles, such as guardrails, curbs, signs, and vegetation, to harden the edges of the work zone. Anticipate impatient or impaired civilian drivers using the shoulders, leaving the paved surface, or weaving through apparatus.
  - f. Dependent upon the incident type, position apparatus in such a manner to protect the pump or aerial operator position from exposure to approaching traffic. Consider a blocking vehicle to protect aerial apparatus stabilizers that are in close proximity to open lanes of traffic.
- 2. Utilize Class B or A apparatus to create a safe parking area for EMS units and other fire vehicles. Heavy apparatus provides a greater degree of protection against a wider variety of vehicles. Operating personnel, equipment and patients should be kept within the “shadow” created by the blocking apparatus at all times.
  - 3. Blocking apparatus should protect a work zone that includes all operational areas of the incident. This includes any hoselines, damaged vehicles, roadway debris, patient triage and treatment areas, extrication work areas, personnel and tool staging areas, and ambulance loading zones.
  - 4. Ambulances should be positioned within the protected work area with their rear patient loading door area angled away from the nearest lanes of moving traffic. Account for the swing area of the side entry door of the unit as well.
  - 5. Identify staging for unneeded emergency vehicles that is off the roadway or return these units to service whenever possible.
  - 6. At all intersections, or where the incident may be near the middle lane of the roadway, two or more sides of the incident will need to be protected.
    - a. Police vehicles must be strategically positioned to expand the initial safe work zone for traffic approaching from opposing directions. The goal is to effectively block all exposed sides of the work zone. The blocking of the work zone must be prioritized, from the most critical or highest traffic volume flow to the least critical traffic direction.

- b. For Engine or Aerial companies where operators may need to work around the vehicle, block so that the pump or operator panel is “down stream” or within the shadow of the vehicle. If not in structural firefighting gear, vehicle operators need to follow Department policy regarding high visibility attire.
  - c. At intersection incidents, consider additional resources to cover the various approaches to the scene. Provide specific directions to additional units regarding traffic control needs. Use resources efficiently.
7. Traffic cones should be deployed upstream of the blocking apparatus toward approaching traffic to increase the advance warning provided for approaching motorists. Cones identify and suggest the transition and tapering actions that are required of the approaching motorist.
- a. While deploying and retrieving cones from an active roadway personnel should face oncoming traffic. When deploying cones, start at a point farthest from the incident scene and work back to the blocking unit. When retrieving cones, reverse the process. Avoid walking in the open/unprotected lanes of traffic whenever possible.
8. For complex or highway incidents, utilize additional traffic control resources in the form of police assistance and State Highway Administration units.

#### **INCIDENT COMMAND PRACTICES**

The **initial-arriving company officer** and/or the **Incident Commander** must assure a protected area for personnel and involved civilians is established and maintained including;

1. Assure that the first-arriving apparatus establishes an initial block to create an initial safe work area.
2. Include traffic control in the ongoing scene size-up and consider the need to retain units on the scene for the sole purpose of traffic management as the incident is mitigated.
3. Assign a parking location for all ambulances as well as later-arriving apparatus.
4. Assure that all ambulances on-scene are placed within the protected work area (shadow) of the larger apparatus.
5. Assure that all patient loading into EMS Units is done from within a protected work zone.
6. Assure all fire and rescue personnel don appropriate protective clothing and/or high visibility attire per MCFRS Policy #26-07AM.
7. The initial company officer and/or Incident Commander is the Safety Officer until this assignment is delegated.
8. Command shall assure that scene lighting and vehicle lighting is not creating a hazard for oncoming motorists.

## **PERSONNEL PRACTICES**

Listed below are safe practices for **individual personnel** when operating in or near moving vehicle traffic.

1. Always maintain an acute awareness of the high risk of working in or near moving traffic.
2. Never assume a passing motorist will do the right thing.
3. Always look before you move!
4. Avoid turning your back to moving traffic.
5. Do not open apparatus doors into open lanes of traffic. Apparatus operators should angle the vehicle to provide a shadow on every incident.
6. If personnel must exit apparatus into active traffic lanes do so methodically and while paying full attention to the oncoming direction of traffic. Engine company personnel initiating a supply line lay are particularly susceptible to tunnel vision while exposed to uncontrolled traffic.
7. High visibility attire must be donned per MCFRS Policy #26-07AM.
8. When working around apparatus, be alert to the proximity of moving traffic.
  - a. Before stepping to the exposed side of the vehicle, stop at the corner of the unit, check for traffic, and then proceed along the unit remaining as close to the emergency vehicle as possible.
  - b. Maintain a reduced profile when moving through any area where a minimum "buffer zone" condition exists and minimize exposure time.

## **LIMITED ACCESS HIGHWAY OPERATIONS**

Limited access highways include Interstate 270, Interstate 495, and the Inter-County Connector. It is important to understand the goal of Maryland State Police and State Highway Administration is to keep the traffic moving on these high-volume thoroughfares. This conflicts at times with the desire of the fire and rescue department to establish safe work zones. A work zone may require shoulder closures, lane closures, a complete shutdown of the travelway, or a combination of each throughout the incident. Complete shutdowns should rarely occur and should be for as short a period of time as practical.

Unique considerations for highway incidents include:

1. First-arriving engine company apparatus shall establish an initial block of the lane(s) occupied by the damaged vehicle plus one additional traffic lane.
2. Additional heavy apparatus should be assigned to the sole function of blocking to layer the protection between responders and passing traffic.
3. Personnel assigned to blocking apparatus should build upon or establish workzone protection as needed, including;

- a. Establish an upstream block occupying a minimum of two lanes plus the paved shoulder of the highway or blockage of three driving lanes of traffic upstream of the initial block provided by the first-due apparatus.
  - b. The position of this apparatus shall take into consideration all factors that limit sight distance of the approaching traffic including ambient lighting conditions, weather-related conditions, road conditions, design curves, bridges, hills and over- or underpasses.
  - c. Traffic cones and/or cones illuminated by flares should be placed upstream of the blocking apparatus by the crew at the direction of the company officer.
  - d. Assign a Flagger person to monitor the response of approaching motorists as they are directed to transition to a slower speed and taper into merged lanes of traffic.
  - e. Notify Command on the incident operating channel of any approaching traffic that is not responding to the speed changes, transition, tapering and merging directions.
4. Police Department vehicles will be used to provide additional blocking of additional traffic lanes as needed, however do not provide the level of blocking protection afforded by heavy apparatus.
  5. EMS Transport Units should always be positioned within the work zone in the shadow of heavy apparatus.
  6. Staging of additional resources off of the highway that are not immediately needed on the scene may be considered. Examples include EMS Transport Units staging at interchanges while awaiting patient triage and treatment completion or Engine Companies staging in anticipation of water supply assignments.
  7. Incident Commanders should establish a liaison with the Police Department as soon as possible to jointly coordinate a safe work zone and to determine how to most efficiently resolve the incident and restore normal traffic flows.
  8. The termination of the incident must be managed with the same aggressiveness as initial actions. Removal of traffic controls needs to be methodical and personnel safety must remain a priority. Crews, apparatus, and equipment should be removed from the highway promptly, to reduce exposure to moving traffic and minimize traffic congestion. The last vehicle to leave the scene should be the blocking apparatus.

